Subterranea

The Magazine for Subterranea Britannica

Subterranea Britannica **April 2016 Issue 41**

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Wartime Treasure Vaults
Sapperton Canal Tunnel
The Origin of the RSGs
Belfast to Ballymena

Subterranea Britannica is a society devoted to the study of man-made and man-used underground structures and the archaeology of the Cold War. The society is open to all and its membership includes all walks of life. Members are invited to contribute to this magazine even if this just means sending very welcome snippets from newspapers and magazines.

Editor: Nick Catford 13 Highcroft Cottages London Road Swanley Kent BR8 8DB
e-mail editor@subbrit.org.uk

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Committee Meeting 16 January 2016 Inside Back Cover

Front cover photo: Front Cover: The Sapperton canal tunnel is an integral part of the Thames and Severn canal, built to link the rivers Thames and Severn. The tunnel was opened in April 1789 after taking five years to build and at over two miles in length it was at the time the longest canal tunnel in the world. It finally closed in 1912 and is now blocked by numerous rock falls where the tunnel passes through unstable layers of fullers earth. This is the first collapse reached from the Daneway portal. Photo Jonathan Maisey

Back page upper: The Ballymena RGHQ which is located on an industrial estatre on the outskirts of the town. The equipment / dirty personnel entrance is on the left with the main entrance in the centre. The air intake and outlets are mounted on the roof above the equipment entrance. Photo Nick Catford

Back page lower: SubBrit members pore over old plans and records in the former Communications Room at Woodeaton, while Dave Johnson of the Oxfordshire County Council Emergency Planning Unit at the left rear explains the bunker's history. Photo Chris Rayner

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Editorial Team
Editor of *Subterranea*: Nick Catford
Editorial Assistants: Martin Dixon & Linda Dixon
Layout: Martin Snow
Graphics: Tim Robinson
Proofreading : Stewart Wild

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The committee of Subterranea Britannica and the Editor do not necessarily agree with any views expressed and cannot always check the accuracy of any material sent in.

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Chairman's Welcome

Martin Dixon

Welcome to the first Subterranea of 2016 – if you're reading this you've renewed your membership, for which many thanks. The income from buoyant membership numbers allows us to produce such a quality magazine. Enclosed with this issue is a consolidated index of our first 40 issues so newer members can track down articles of interest and perhaps order back issues via the website. The range of topics covered and contributing authors over the period is truly impressive. Thanks to Linda Dixon for compiling the index for us all.

As a public charity, we are obliged to ensure that our activities contribute 'public benefit' and a major strand in achieving this is our main website. In 2015 we had over half a million visitors to the website and it is recognised as a valuable resource by both the general public and researchers alike. Members of the Committee have started adding new sites recently – if you are interested in becoming a contributor then please get in touch with our webmaster Richard Seabrook. We also have a growing social media presence and over 6,500 people follow our activities through these channels.

Although our web presence often satisfies the public's curiosity, we also get a steady stream of enquiries. The three most common questions are probably:

* Can I use photos on the website? Copyright of photographs remains with the photographer and permission is nearly always given especially for community groups or personal use provided that acknowledgement is made. A fee is usually expected from a commercial publication.
* How do we get to visit sites? The general answer is to look at the 'Places to Visit' tab or buy our site directory and/or join Sub Brit for access to trips. For some enquiries about specific sites we can sometimes suggest another society such as the London Transport Museum for access to disused tube stations.
* Can you find me an underground site where I can hold my exhibition/art show? This is usually from students who are often after an atmospheric location in central London at zero cost. Sadly (for them) it is not possible for us to provide such magical locations!

Other Sub Brit members often help out by answering questions where they have particular knowledge which is much appreciated. As examples, here are some questions we've already been asked in 2016 along with the answer from an expert advisor:

Q What happened to the Hawker Hunter that used to be outside 8 Group ROC HQ?

It's in the Newark Air Museum. (John Shere)

Q Are there any ex-radar sites in Pembrokeshire?

List provided. (Bob Jenner)

Q Can I film a news report outside the original 1880 Channel Tunnel entrance?

Yes, it's on a public right of way but the door is locked! (Nick Catford)

Pleasingly, some people get in touch to provide information that we add to the members' forum or our website as appropriate. For example, the fine 3D scan of Clapham North that was posted to the forum arrived unsolicited from its creator. Similarly, approaches from the press sometimes give rise to articles in print or image that feature Sub Brit and our interests. David Shaftel recently wrote an extensive piece for the *New York Times* featuring UK Cold War shelters and Sub Brit. Particular thanks are due to Mark Russell and Ed Combes who equipped Cuckfield ROC Post 'out of season' for his visit. Many press enquiries are speculative but it is pleasing to see our activities promoted in a constructive and considered fashion.

So as well as our growing membership, there is strong evidence of a deep (pun intended) interest in our underground heritage from the public and professionals alike. Long may it continue.

chairman@subbrit.org.uk

Subterranea Britannica

Autumn Meeting 2016

Saturday 15 October, commencing at 10.00am

venue to be confirmed in Belfast, Northern Ireland

Following the membership survey which showed a demand for holding some of the biannual meetings in the regions, very successful meetings have been held in Liverpool in 2012 and in Newcastle in 2014. Another one is proposed for this Autumn in Belfast on Saturday 15th October, and once again, as Belfast is another fascinating location for subterranean and other sites of interest, we hope to have a programme of visits on the following day, Sunday 16th October. More details are to follow

The programme & booking form will be on the website.

Please put the date in your diary now!

SUBTERRANEA BRITANNICA DIARY

Summary of Forthcoming Events

Sub Brit specific events

2016

6 - 9 May SB Rome Weekend

25 June SB Committee meeting

17 September Paddock open day

15 October SB Autumn Meeting (venue tba)

Other underground-related events

2016

6 - 11 May Dartmoor Tinworking Conference, Tavistock

7 - 14 May Fortress Study Group, Mallorca & Menorca Tour

14 May, 11 June, 9 July, 13 August, 10 September Reigate Caves public open day

29 May, 3 July, 31 July, 28 August, 10 -11 September, 28 October
Carrs Mine Trips & Open Day, Nenthead, Cumbria

17 - 19 June NAMHO Conference, Dublin

16 - 31 July Festival of Archaeology, UK

6 - 7 August Nenthead Mines Conservation Society:
120 Years of the Vielle Montagne Zinc Co in the North Pennines

13 - 20 August EuroSpeleo, Yorkshire Dales

6 - 11 September International Mining History Congress, Linares

8 - 11 September Heritage Open Days, England

9 - 14 September Association for Industrial Archaeology Conference, Telford

10 - 11 September European Heritage Open Days, Northern Ireland

12 - 18 September Doors Open Days, Scotland

17 - 18 September London Open House

September Open Doors, Wales - Every weekend in September - programme available August 2016

18 - 21 November SFES (Société Française d'Etudes des Souterrains) Congress, Arras, France

2017

6 - 10 March Hypogea, Cappadocia

11 - 13 May International Early Engines Conference, Elsecar

For web links to these events please visit www.subbrit.org.uk/events
or contact the Society concerned

If you know of other relevant events run by other societies, please let us know so that they can be advertised in the next edition and on the website

Absent Friends

Obituaries by Martin Dixon

We are sorry to have to record the death of three Sub Brit members who all made significant contributions to our society and will be sadly missed.

Terry Wiseman

Terry was a veteran who had seen many faces of the UK's civil defence organisations. He was a Senior Signals Officer in the Civil Defence Corps and later became Chief Observer at Lincoln number 40 ROC Post (Market Rasen). The post was immaculately maintained and won the best kept post award for two years running of which Terry was proud.

He was very knowledgeable about the Royal Observer Corps and in 2005 gave a memorable presentation with his wife, who was also an ROC member, at a Sub Brit Day Conference on the way in which ROC Posts would have responded in the lead up to and launch of a nuclear conflict. Terry still had his uniform and brought it with many other artefacts to display. He often saw the funny side of things – such as the almost certainty of tripping over the BPI mount when on exercise.

Terry continued to be a regular attendee at Sub Brit Day Conferences and was always generous in his praise of others who were active contributors to Sub Brit. Despite failing mobility he was always smiling and maintained a positive outlook on life. Predeceased by his wife, Terry was a fine representative of the ROC who would have left their own families in order to serve and save their country.

John Germain

We were saddened to hear that John passed away suddenly on 12 January 2016. Many will remember John from the 2012 Jersey weekend where he gave huge assistance to Brian Hillman in terms of arranging site access and providing local knowledge. John was full of infectious energy and enthusiasm. He was an active member of the Channel Island Occupation Society, and also of the local St Mary's Rifle Club.

John also helped organise private Sub Brit trips to Alderney and to Guernsey following the Jersey weekend where his knowledge and hospitality was again demonstrated. The Germain family has a long history in the Channel Islands, being involved with tobacco production there since 1820. John himself always made it clear that he lived in the British Channel Islands.

John's death at just 57 was hugely premature and we send our deepest sympathy to his wife Caroline and daughters Francesca and Laura.

Peter Ashley

Peter Ashley died on 10 November 2015 at the age of 80. His interest in underground matters and the Cold War more generally was triggered when he did his National Service at Cold Hesledon Rotor Station in County Durham. Cold Hesledon was an R1 CEW (Centimetric Early Warning) site and Peter particularly remembered the onerous duty of servicing the standby generator which was housed within the bunker.

Peter joined Sub Brit in 1999 and was an active member on our email list – sometimes correcting others with his personal knowledge but always in a very gentle way. In latter years he became less mobile and was a great supporter of the programme to improve disabled access to London's tube network. To quote Peter 'it is very frustrating sitting on one's backside most of the time when others are out and about having all the fun'.

We pass our condolences to Peter's wife Ann and the rest of his family.

News

Miscellany compiled by Nick Catford & Paul Sowan

NEWS – ARCHAEOLOGY

Excavations in search of a quarry tunnel and a well on National Trust land at Reigate, east Surrey

The Wealden Cave and Mine Society have completed Phase 1 of an examination of National Trust land at Colley Hill, northwest of Reigate, where a building-stone quarry tunnel was reportedly rediscovered in the late 1890s during the sinking of a well. The well-house, some pipework, the well location, and a very short stretch of tunnel were found and have been recorded, and the excavation is now back-filled. Plans are to be submitted to the National Trust for a Phase 2 investigation underground. The site is very close to the Colley Hill hearthstone mine, the last active mine in the county, closed in 1961.

SOURCE: WCMS newsletter '*News of the Weald*', December 2015.

Excavations at Pitchcroft limestone mine near Newport, Shropshire

Limestones of various kinds and geological ages have been mined or quarried underground at numerous places in England, Scotland and Wales. Mines in the older and harder limestones in or near the coalfields have yielded limestone much of which has been used as a flux in iron-smelting. Jurassic limestones from near Bath northeastwards towards Northamptonshire and Lincolnshire have often been quarried underground for squared building-stone. And the soft porous limestones (chalk) of southern and southeastern England have been extensively mined for agricultural and brick-making and other purposes, and also to some extent as building-stone.

At Church Aston, near Newport (Shropshire), a limestone mine at SJ 739172 associated with a canal is known to have been at work by 1826, and to have ceased operation as a result of flooding in 1860. It may have been older, as limestone mining in the county is known to have started by 1794. The site is shown on several historic maps, and lies now in an agricultural landscape. Three shafts over 400 feet deep are known to have been sunk and have been located, one being for winding and another for pumping. The third was possibly for access and / or ventilation.

The winding shaft had a short tunnel from near the top whereby limestone could be conveyed to a wharf on the Donnington Wood Canal. The excavations reported have revealed the foundations of the winding-engine house and seating for a haystack boiler. Excavations at the pumping-engine house are ongoing.

SOURCE: POYNER, David, 2015, Excavations at Pitchcroft limestone mine, Church Aston. *Mining History* 19(3), 61 – 66.

Archaeological discoveries from the Crossrail works, London

Most of the running and station tunnels of Crossrail are of course deep enough to run below without disturbing the top few feet or yards of London's subsoil. But you can't have this sort of railway without stations with access to ground level and, in many instances, interchanges with already existing transport infrastructure. Nor can you drive such lengths of tunnels without digging shafts for removing excavated material, bringing in equipment and, in the longer term, providing airways for ventilation, means of emergency access and so forth. Consequently, a great deal of near-surface ground along with contained artefacts from at least as far back as the Roman occupation is being necessarily disturbed.

Fortunately, teams of archaeologists have been recording artefacts and environmental evidence as work has progressed. And as archaeological or any other sort of excavation is necessarily destructive of stratification for relative dating, and the relationship of one find to another and to the stratigraphical context, it must be and is in due course preserved and made accessible by publication. The monthly magazine *Current Archaeology* has published an overview of the highlights of 'one of the most extensive archaeological programmes ever undertaken'.

A Brunel turntable uncovered at Westbourne Park. Photo Andrew Smith

The archaeological phase of Crossrail work ended in December 2015. Discoveries reported in the cited article range from Ice Age large mammals to relics of Isambard Kingdom Brunel's broad-gauge Great Western Railway and, on the way, reminders of the Black Death at Charterhouse and of Thames-side shipbuilding. A printed volume on *Crossrail archaeology and history of west London* is due to be published later in 2016, and doubtless much more will appear in both popular and academic styles in due course.

SOURCE: DURRANI, Nadia, 2016, Fast track to the past: celebrating Crossrail's archaeology. *Current Archaeology* 27(1)(313), 36–43.

Inhabited sea caves at Black Isle, Scotland

Evidence for Iron Age and Early Medieval (Pictish) inhabitants of sea caves on the Black Isle near the Moray Firth on Scotland's east coast has been reported. In the course of the Rosemarkie Caves Project 18 sea caves have been considered, with test pit excavations conducted in the floors of those thought to be most promising from an archaeological point of view. Deep, well-stratified cave floor deposits found have revealed charcoal and animal bones, with dates ranging from 2nd – 4th, 7th – 9th, and 11th – 12th centuries.

The animal bones represented species likely to have been eaten by human inhabitants, such as cow, goat, pig and sheep. A most interesting find was a small boulder with an incised depiction of an unidentified animal, the date of which is not clear. For further information visit www.spanglefish.com/rosemarkiecavesproject

SOURCE: ANON, 2015, Picture puzzle on the Black Isle. *Current Archaeology* 26(9)(309), page 9.

Excavation reveals prison cell shapes and dimensions at Salford, near Manchester

The Georgian-period New Bailey Prison at Salford, across the river Irwell from Manchester, was when it opened in 1790 the largest in England. But today, at surface, no trace of it remains visible. The establishment closed in 1868 and the massive above-ground buildings were in due course demolished, to be replaced by railway sidings, then a car park. Foundations and sub-surface spaces, notably the incredibly small cells, have now been revealed by archaeological excavation. What has been brought to light adds to an appreciation of the 750 inmates' prison experiences derived from a 1794 detailed map and an Ordnance Survey large-scale plan of 1851.

SOURCE: READER, Rachel, and Michael NEVELL, 2015, New Bailey, Salford: prison's industrial revolution. *Current Archaeology* 26(9)(309), 32–38.

The United Kingdom's remotest underground site, St Kilda

The least likely British underground and Cold War sites to be visited by a member of Subterranea Britannica are probably the 1st- or 2nd-century BC souterrain and the military establishment on Hirta, one of the four main islands of the St Kilda archipelago, a long way out in the North Atlantic beyond the Outer Hebrides.

Souterrain on St Kilda

The last 36 permanent inhabitants left the islands on board HMS *Harebell* on 29 August 1930, but there have been weather station and radar station personnel at this lonely place for some decades and currently the 'substantial military base' dating from 1957 is supplied every Tuesday and Friday by helicopter from Benbecula. An archaeological landscape survey has now been published by the Royal Commission on the Ancient and Historical Monuments of Scotland, and reported in *Current Archaeology.*

SOURCE: CATLING, Chris, 2016, St Kilda: the last and outermost isle. *Current Archaeology* 26(12)(312), 26–33.

NEWS – CONSERVATION & HERITAGE

RAF Holmpton bunker museum reopens after 18 months' refurbishment

The former RAF Holmpton museum near Withernsea in East Yorkshire closed at the end of 2014 having provided fully guided tours for ten years. The museum staff were finding it difficult to handle the volume of visitors with their 'one tour a day'. After careful consideration, it was decided to completely refurbish the bunker and then reopen with a self-explore free-flow format. This coincided with the purchase of the site from the MoD and also the acquisition of the Paul Blake Cold War Equipment Collection.

Over the last 18 months, the exhibition has been totally stripped out and refurbished with many new exhibits. A number of new rooms and areas have also been opened to the public for the first time. It is hoped the new format will make the site much more accessible to those wishing to visit. Visitors will now be able to come along at any time during the opening hours (11 am – 5pm every day), stay as long as they like and explore the bunker at their leisure with the bunker team on hand to answer any questions and provide access to special areas (AC plant room and emergency exit tunnel) and demonstrations of equipment. Photography and video are welcome. Guided tours and group visits will still be available if arranged in advance.

The emergency exit tunnel will now be available to visitors for the first time. Photo Nick Catford

RAF Holmpton became fully operational in 1954 as an integral part of the national ROTOR Radar programme and started life as a combined GCI and CHEL station. Holmpton was equipped with a Type 54 CHEL radar mounted on top of a 200ft tower and the principal GCI radar was a Type 7; this was replaced in 1958 by a Type 80 long range radar. RAF Holmpton remained operational as a Master Comprehensive Radar Station until 1974 when it was put on care and maintenance, being used as a training facility until 1984 when the bunker was refitted as the National Wartime Command Centre for RAF Support Command.

With the end of the Cold War in 1991 there was no requirement for such a command facility and Holmpton closed in 1992. Between 1992 and 1995 the bunker was used for specialist training by the RAF Regiment and the RAF Police. In 1995 further extensive work was carried out to adapt the site for use as an experimental operations centre which remained active until 2000.

On 10 February 2003, management of RAF Holmpton was handed over to the Holmpton Initiative Project Planning Office, an independent finance initiative to restore and open the bunker to the public and provide a permanent exhibition of the station's life between 1951 and 2000. See: www.rafholmpton.com for opening times and full details.

SOURCES: Dr. James Fox (curator of RAF Holmpton Museum) and Sub Brit website www.subbrit.org.uk/rsg/sites/h/holmpton

Dudley Museum threatened with closure, West Midlands

Dudley Metropolitan Borough Council faces a 70 percent reduction in government core funding over the next three years. The resulting £50m funding gap has led to a proposal to close the Borough's Museum and Art Gallery. This dismal result of Chancellor George Osborne's 'austerity' policy, response to irresponsible lending and thus losses by the banks, is being seen the length and breadth of the UK.

The Dudley limestone mines and canal tunnel and adjoining Black Country Museum will be known to many Subterranea Britannica members, and of course these important relics of the industrial revolution feature in the museum's and other interpretive displays. Members seeking further information, or to protest, should email Anthea Jones at anthea.jones@dudley.gov.uk and the Keeper of Geology at the museum Graham Worton at graham.worton@dudley.gov.uk .

SOURCE: ANON, 2015, Dudley Museum & Art Gallery under threat of closure. *Down to Earth* 93, 20–21.

'Mail Rail' opens to the public in spring 2017, London

A £26m project backed by the Heritage Lottery Fund is rebuilding the Royal Mail museum at Mount Pleasant in central London to hold its vast collection and archives, and restoring a stretch of the underground railway as a visitor attraction. A 1km ride running beneath the Mount Pleasant sorting office in Clerkenwell will take visitors on an audio-visual journey that 'peels back' the layers of the Mail Rail, from its initially-abandoned construction during the first world war, through its 1930s heyday, and up to its eventual demise.

The old trains were left as they were when the line shut 16 years ago, and have since only been used for occasional events. However, the new Mail Rail experience will bring in fresh trains, and carriages with Perspex hoods.

Postmen stacking bags from conveyor into containers prior to loading them onto the trains

The ride will be the star attraction of the new Postal Museum. The diminutive trains will depart from the subsurface depot at the back of the Mount Pleasant building, descend through a tightly curved tunnel to run through the subsurface station, around a reversing loop, back through the station, and then back to the surface. En route visitors will see audiovisual and platform displays explaining the line's history.

The Post Office Railway commenced operation in 1927 with automatically controlled trains conveying mails between King's Cross and Paddington stations and six major sorting offices. There were 22 miles of two-foot-gauge tracks, but the entire system went out of use in 2003, in which year Subterranea Britannica members were allowed a visit to the Mount Pleasant sub-surface station to see the driverless trains in action, although not by then carrying mails. In earlier years groups could arrange visits to see this station fully at work. The museum hopes for 186,000 visitors in its first year.

SOURCE: *The Guardian* and *The Londonist* 4 February 2016; *The Guardian*, 5 February 2016, page 17.

Kennedy's Peanut Island bunker may be forced to close

The bunker where President Kennedy would have been whisked if World War III erupted while he vacationed in Florida may face a bigger threat than Soviet missiles ever posed: a battle between its operators and the Port of Palm Beach.

The once top-secret fallout shelter, code name 'Hotel', and the redundant Coast Guard station on Peanut Island are now a tourist attraction and the focal point of a long-running legal war between the port, which owns the island, and Palm Beach Maritime Museum, which leases the attraction.

The port's commission and Palm Beach County have blocked attempts to make the attraction financially stable. The commission thwarted a $500,000 grant last year and the county slashed the number of lucrative weddings that can be performed at the picturesque Coast Guard boat house from 30 to 3 per year, and banned the construction of a restaurant. The site's $200,000 annual maintenance budget is barely covered by admissions and donations.

Despite accusations that the commission wants to demolish the bunker and coastguard buildings their lawyer says this is not the intention and they hope to find a better caretaker when the museum's lease expires in 2017.

To visit the bunker, which opened to the public in 1998, about 200 tourists a week take a short boat ride to the man-made Peanut Island, named for an aborted attempt to use it to ship peanut oil almost a century ago. Once inside the bunker, a 40-foot tunnel slopes down to a second door where entrants would have checked themselves with Geiger counters and, if radioactive, stripped and showered. Fresh clothes, if needed, would have been slipped through a slot in the final door. It opens to the single room where President Kennedy and 30 members of his family, aides and military advisers would have lived for up to a month beneath a 12-foot ceiling, two metal roofs sandwiching 18 inches of cement and 12 feet of soil.

NEWS – MILITARY & DEFENCE

Restoration of Dutch bunker in Java

The Surakarta administration in Java has postponed a plan to restore a century-old bunker as a tourist attraction because of a lack of funds.

The 16-metre by 24-metre bunker was discovered in 2012 within the Surakarta City Hall compound by the Central Java Cultural Heritage Preservation Centre. The administration allocated Rp 15 million for the bunker's excavation, which was completed in 2013. Since then, though, the bunker has been left untouched, and its two rooms, separated by thick walls, are now filled with rubbish and partially flooded.

Once further funds are approved, the money would go first to determining the original purpose of the building through a thorough study, as well as to the creation of detailed engineering design. The plan is to turn the bunker into a gallery displaying historical photographs and paintings of the city hall.

Entrance to the partially flooded bunker

The bunker is a legacy from the Dutch era. Most buildings built during this period had bunkers for defensive purposes. The City Hall complex was previously used by high-ranking officers of the Dutch colonial government as offices and as a residence. The bunker is thought to have been built during the governor-generalship of Herman Willem Daendels between 1890 and 1900. In the past, the area above the structure was a park used to conceal the existence of the bunker.

The existence of the bunker had long been an open secret, especially among local people. Before the bunker was unearthed, the area surrounding the subterranean structure was used as a children's playground.

SOURCE: *The Jakarta Post*, 11 March 2016.

Three bunkers that got away, Kent

Three cliff-top concrete bunkers, presumably of World War II vintage, are now down on the beach at Warden Point on the Isle of Sheppey in Kent. One remains intact, while the other two have fallen apart. Health and Safety note: members who may want to have a look at these remains should bear in mind that landslip mudflows can be treacherous. It is all too easy to sink up to your waist in mud-flows without much warning, and all too difficult to extricate yourself or be rescued by others.

SOURCE: MAYNARD, Derek, and Edward N. BROMHEAD, 2015, Landslide activity in London Clay at Warden Point, Isle of Sheppey, SE England. *Quarterly Journal of Engineering Geology and Hydrogeology* 48 (3/4), 159–162.

Former ROC Group Control site in Norwich could become a Starbucks

Developers are hoping to build a Starbucks and retail unit on the site of the former Royal Observer Corps headquarters on Charterwell Road, Norwich. Plans submitted to Broadland District Council by Sigma

(Marlborough) Ltd seek permission to redevelop the land.

Until 1991 the site had served as the group headquarters of 55 ROC underground monitoring posts in Norfolk for 30 years. Since then there have been numerous applications to redevelop the land mainly as fast food outlets. The latest, submitted in November last year, is for a 1,784 sq ft drive-through cafe and a 3,000 sq ft retail unit. It would include a car park with 31 spaces and a pedestrian access point from the nearby Clabon Road.

The balcony at Norwich Group Control in 2002. The Post Display Plotters would have sat behind the revolving boards on the left. Photo Nick Catford

Sprowston Town Council has already objected to the proposals, describing them as 'gross overdevelopment' and an inappropriate use of the site.

The site was once the headquarters of the 6 Group Royal Observer Corps and opened in 1961 and remained in use until 1991 when the ROC was stood down. There was a spirited local campaign to restore the bunker as a tourist attraction in 2008; the owner, who had always been hostile, demolished the bunker in early July 2008 to put a halt to the campaign even though he didn't have planning permission to develop the site. After some difficulty a visit by some Sub Brit members was arranged in 2002.

SOURCE: *Eastern Daily Press,* 23 February 2016.

Nottingham RSG site sold and development begins

New homes will bring much-needed regeneration to a patch of land surrounding the derelict former Regional War Room and RSG 3 in Nottingham. Plans for 345 homes at Aspley Orchard, in Chalfont Drive moved a step closer after the site was sold to a housing developer.

The first homes are expected to be built by this autumn. The 25-acre plot, one of the city's largest residential development sites, already has planning permission and has now been sold by the Land Registry to Bellway Homes.

It includes the Grade II-listed, three-storey nuclear bunker, which dates from the 1950s and is known as the 'Kremlin'. It will be retained, with buildings surrounding the bunker used by the Land Registry and Department for Environment, Food and Rural Affairs in recent years.

The Lamson Tube room in the extension of the Nottingham RSG. See feature Origin of the RSGs on page 37. Photo Nick Catford

These will be cleared to make way for a range of two-, three- and four-bedroom properties, including some detached homes.

The bunker was visited by members of Subterranea Britannica in 2002. Since then, apart from a survey for English Heritage, the bunker has been out of bounds to everyone due to asbestos contamination.

See feature in this issue of *Subterranea* 'The Origin of the RSGs' on page 37.

SOURCE: *Nottingham Post,* 22 February 2016.

Greenham Common GAMA site for sale or rent

The 74-acre site already has planning consent for the storage of over 6,000 cars for 10 years. It is suitable for alternative uses subject to planning and scheduled monument consent.

The property comprises six triple missile bunkers. The bunkers are constructed with 1.5m thick reinforced concrete to the roof with 2.6m of sand above and were designed to protect against bomb blasts. Internally they are each split into 3 bays with hydraulic doors at either end which have been decommissioned. The doors are estimated to weigh approximately 25 tonnes each. Other buildings on the site are five storage bunkers, underground garage, maintenance shed, store shed, guard room, entry post and garage. The remainder of the site comprises scrubland, the whole being surrounded by a triple, part quadruple, and boundary security fence. A small part of the site is designated as a Site of Special Scientific Interest. The site is designated as a Scheduled Monument.

RAF Greenham Common, opened in 1941, was associated with many notable historic wartime events including *Operation Torch* in 1943 (the invasion of North Africa), the D-Day landings in June 1944 and *Operation Market Garden,* the parachute drop to capture the bridge at Arnhem.

In 1946 the base was closed and returned to Newbury District Council, but in 1951, with worsening international relations brought to a head by the Korean War, the heath was re-requisitioned and work began to reconstruct the base to receive USAF Strategic Air Command (SAC) bombers. The remodelled form of the airfield with its long 3,048m single runway and concrete apron in front of the hangers was the classic form for many postwar airfields.

One of the six triple missile bunkers. Photo Nick Catford

Throughout the remainder of the 1950s it was one of the four principal SAC airfields in Britain and B-47 Stratojets and their refuelling tankers were regularly rotated through Greenham Common; from 1958 a number were maintained on constant standby as part of the Reflex Alert Scheme.

In April 1964 the airfield passed back to the RAF, but in 1968 the USAF again reoccupied it, this time as a standby base. Around 1980 Greenham Common was selected as one of six bases in Europe for the deployment of Ground Launched Cruise Missiles (GLCM), making the airfield a prime target for Soviet attack. It was at this time that the airfield received worldwide recognition, through the women's peace camp and their opposition to escalation of the nuclear arms race represented by the introduction of GLCMs.

The last GLCMs were withdrawn from Europe in mid-1991 under the terms of the intermediate-range Nuclear Force (INF) Treaty, signed in June 1988. The treaty lasted 25 years and is now defunct. RAF Greenham Common closed in 1992 although the GAMA site remains and is now considered of significant historical importance.

The site is being marketed by Quintons, 38 London Road, Newbury RG14 1JX. www.quintons.co.uk

SOURCE: Quintons sale particulars.

Developments at Clapham South deep air-raid shelter, London

Transport for London and the London Transport Museum have plans for new uses for the World War II deep air-raid shelter at the southeastern corner of Clapham Common. The surface building, a rotunda built between 1940 and 1942, was listed Grade II in 1998. Planning permission from the London Borough of Lambeth has been secured for the creation of a café or restaurant and exhibition space in this structure. The LT Museum plans to use the display space in connection with pre-booked 'Hidden London' deep shelter tours.

The sub-surface tunnels, at a depth of 180 steps, came into use as a civilian shelter in 1944 when attacks on London were intensified by the introduction of the V1 and V2 weapons. There was space for up to 8,000 shelterers, and the tunnels at this site (one of seven provided below Northern line stations) contain the best-preserved wartime signage.

The shelter has seen numerous postwar uses, including temporary accommodation for 492 migrants from Jamaica in 1948, many of whom were recruited by London Transport to crew buses and trains in the capital. In 1951 the site was a hostel for visitors to the Festival of Britain requiring cheap bed-and-breakfast accommodation. Secure archive storage has also featured here.

SOURCE: ANON, 2016, Blitz remembered. *Modern Railways* 73 (809), page 44; and ANON, 2016, Plans for Clapham South deep-level shelter. *Newsletter Greater London Industrial Archaeology Society* 282 (February 2016), 8–9. SEE ALSO: www.ltmuseum.co.uk/whats-on/hidden-London

Converted Chain Home radar bunker wins prestigious accolade

The former Sennen Chain Home radar receiver bunker near Porthcurno, Cornwall, was named as one of the 50 Best Cottages in Britain by *The Times* in February, having been recently opened up as a unique holiday

home by the current owner following renovation work.

The bunker, originally built in 1941, was left disused for many years, and at one time even housed potatoes, before being converted into a home by its previous owner. It has since undergone a renovation to include central heating and updates in order to create a comfortable holiday home with four bedrooms, three bathrooms and an open plan living/dining area.

SOURCE: *The Cornishman,* 16 February 2016.

Listed building status for a DIY domestic nuclear bunker at Taverham, Norfolk

A home-built nuclear fallout shelter built in a Norfolk back garden at the height of the Cold War has been given protected listed status as a reminder of the terrifying spectre of nuclear war in the 1980s. It is the first private bunker to be listed and has been singled out as an important example of the public's anxiety in the face of nuclear attack.

Noel Barrett designed and built the bunker for his wife and two sons after deciding Government advice to shelter behind a door leaned against a wall in the event of nuclear attack was 'lunacy'. With his home close to several RAF bases that could be targeted by Russian nuclear missiles, in 1982 he decided to take matters into his own hands and called in favours from friends in the building trade. Mr Barrett, who at the time ran a nearby fish and chip shop, spent thousands of pounds and several months building the bunker from reinforced concrete, brick and steel, in three acres of woodland behind his home in Taverham, Norfolk.

The shelter is around six feet underground and has home comforts including carpets and a spa bath which doubled as a water store.

Entrance to the bunker

The shelter was designed with enough storage and food to give refuge for at least two weeks, until radiation levels might have died down. But his attempt to resist nuclear destruction had not counted on planning regulations and the local council threatened to have the bunker demolished. The council's opposition meant the bunker was never completed and an electric generator, air filtration system and beds for himself, his sons Nigel and Mark, and wife Patricia, were never fitted.

A number of above-ground and subsurface Cold War structures have already been Scheduled as Ancient Monuments, a category generally considered to be uninhabitable structures and indeed often roofless ruins, earthworks and the like.

SOURCE: *Daily Telegraph,* 15 January 2016.

Another one bites the dust

In June 2015 East Herts Council's development management committee approved a proposal to demolish and redevelop Sovereign House in Hale Road, Hertford. 84 new homes will be built on the site. Demolition started in December 2015.

Sovereign house opened in 1969 as an area government office including a court, tax office etc. It incorporated a single-level basement which contained a Sub Regional Control in Civil Defence Region 4.

From 1965 there had been a policy to build new office blocks to centralise local government offices and, where appropriate, incorporate a Sub Regional Control in basement – such sites were proposed at Ruthin, Chesterfield, Southport, Hertford, Basingstoke; only the latter three were built.

In 1969 Region 4 had Sub Regional Controls at Bawburgh for Norfolk and Suffolk, Vange AAOR for South and East Essex, Cambridge (the old RSG4 building) for Cambridgeshire and Peterborough; Hertford, which was SRHQ 42, covered North and West Essex and Hertfordshire.

Hertfordshire County Council had approached the Home Office to use part of the proposed Sovereign House as County Control but there was not sufficient space so a converted basement of the tax office in County Hall was used in 1968. The Sub Regional military HQ was at Basingbourne Barracks in Royston.

Photo Howard Martin

The new office basement 'bunkers' were not blast protected just fallout protected, as was the practice in late 1960s, however standby generators and air-conditioning plant were provided.

The whole SRC/SRHQ network was mothballed in 1968 so, when built, they were immediately put into care and maintenance when opened in 1969 although theoretically they were available for use if required.

When the civil defence infrastructure was reactivated from 1980, most sites were found to be in poor condition when surveyed. An exercise took place at Sovereign House in 1983 but the above-ground offices were used as the 'bunker' was not useable. The office block at Basingstoke (Alençon Link) was often flooded! Despite this, it was later designated RGHQ 6.2 from about

1984 until closure in 1991. Its blast protection was not upgraded and it was rather too small, so in times of war, the upstairs accommodation would have to be used as well. The same situation applied at Dukes House in Southport.

After closure, the bunker was used as a regional record office for court service and for that reason requests for visits were always refused.

Hertford had a number of bunkers, Hertford County Hall basement housed the County Control (now an archive store), Hertford Divisional Police Station built in 1969 had a protected control room; this has recently been demolished. The basement of the castle was Hertfordshire County Council CD control until 1968.

RGHQ 6.2 in Basingstoke was demolished in 2002. RGHQ 10.1 at Southport is an office for Fletchers Solicitors.

SOURCE: Keith Ward.

NEWS – MINES & MINING

United Kingdom's last deep coal mine closed at Kellingley, West Yorkshire

The National Coal Board, when established by nationalisation of most of the coal industry in 1947, took charge of 1,400 collieries, 85 brickworks, one cinema, one slaughterhouse, and one holiday camp. Kellingley Colliery near Wakefield, the last of our operating deep mines, closed on Wednesday 16 December 2015 with the loss of 451 employees. Opened by the NCB in 1965 and privatised in 1994, Kellingley once employed some 3,000 persons.

At closure, miners' access to the working faces was down an 800-metre shaft followed by an 11 km underground journey partly by train, party by conveyor, and finally on foot. Getting to and from the face took up to two and a half hours of the working shift. Miners worked in hot (temperatures up to 30º C) and humid (up to 98%) conditions. During its working life, 17 employees at Kellingley lost their lives.

The operating company, UK Coal, will in due course be wound up. Presumably contractors will bulldoze spoil tips back down the shafts and seal them, and demolish all surface structures, rail tracks, and the like. Whether or not any subsurface steel rail lines and structures will be salvaged is not clear. British coal is still won from 26 opencast mines. Historically, an estimated 3,000 subsurface coal mines in the UK employed about a million men since the start of deep mining. Ironically, Lord Ezra (Derek Ezra [1919 – 2015] a former Chairman of the NCB), who spent his entire working life in the industry, died on 22 December shortly after Kellingley closed.

Subterranea Britannica members wishing to see inside a coal mine are now limited in their options. One or two very small independently operated mines, at least one of them offering guided public tours underground, are still

operated in the Forest of Dean in Gloucestershire. And the National Mining Museums for both England and Wales, at Big Pit and at Caphouse near Wakefield, both offer underground tours led by former deep miners (that for Scotland south of Edinburgh does not, with access to extensive surface buildings only). A deep mine guided visit is also on offer at Blegny near Liège in Belgium, as some Subterranea Britannica members will recall.

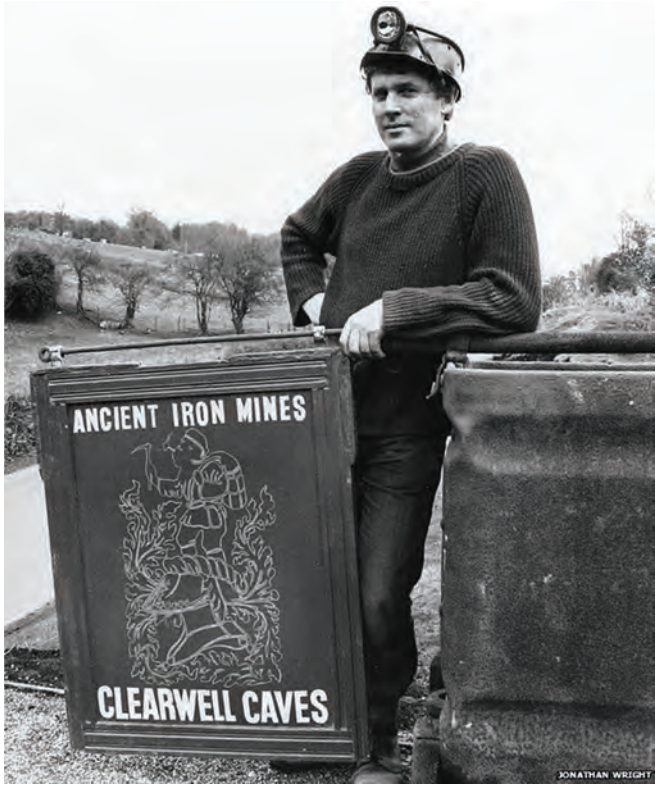
The closure of Kellingley ought to be good news for the environment on account of reduced carbon dioxide emissions from coal-fired power stations and resultant global warming. But it is bad news for employment prospects. In fact, it is bad news all round, as cheaper coal imported from beyond Europe will continue to be burned. Diesel-fuelled ships will add to greenhouse gas emissions from burning imported coal at the surviving UK electricity generating stations. Currently, 80% of such fuel is imported. At present electricity generated in the UK is from coal (20%), gas (30%), nuclear (21%) and renewables (25%).

SOURCE: PIDD, Helen, 2015, 'It's like being on death row, we hear the keys jangling'. *The Guardian*, 18 December 2015, page 6.

Death of Ray Wright of Clearwell Caves, Forest of Dean, Gloucestershire

Ray Wright, who opened the Clearwell 'Caves' as a public visitor site in the Forest of Dean in 1968, died on 7 August 2015. He was born in London on 9 January 1930 but moved to the Forest in or about 1939, where he left school at 14 and worked at first for a company in Mitcheldean which later became part of the Rank Xerox corporation.

With an early interest in caving, exploring for example the disused Wigpool ironstone mine, he became in 1964 a founder member of the Royal Forest of Dean Caving Club. In 1968 he opened the 'caves', which are actually another disused ironstone mine, at Clearwell, and developed the associated museum. Alongside the tourist 'caves' he also offered guided and more sporting and adventurous underground visits into another mine entrance nearby, calling for full caving equipment. Ray was for many years secretary to the Forest of Dean Free Miners' Association and, from 1992, served as one of four Verderers (officers of the Royal Forest).



Ray Wright in 1968 when the caves first opened as a tourist attraction

Both sites are of considerable geological and mining history interest, as they contrast strongly with ironstone mines in stratified iron ore beds in, for example, Northamptonshire. In the Forest, the ironstone is found where it was deposited in pre-existing three-dimensional natural solution cave networks. Ray's son Jonathan, and daughter, Elaine, as partners in the business, are expected to continue the Clearwell Caves visitor attraction which now, with an accompanying café and museum, attracts around 50,000 visitors a year and is recommended as well worth visiting.

SOURCE: TAYLOR, Paul, 2015, Farewell, Ray Wright of Clearwell. *Descent* 246, page 15.

Recent exploration at the underground building-stone quarries at Windrush, Gloucestershire

There is impressively ancient subterranean stone quarrying at Windrush, revisited by Subterranea Britannica during the 2015 Cotswolds Study Weekend. Since our first visit, much exploration and work has been done by members of the Gloucestershire Speleological Society. The tunnels of 'Windrush 1' have been provided with an improved and stabilised entrance. A whole additional network of tunnels at 'Windrush 2' has been made accessible by way of a newly excavated user-friendly entrance which is even equipped with an internal staircase with hand rails! Connection has been made with 'Windrush 3' and digging for an expected 'Windrush 4' has been commenced.

SOURCE: DUXBURY, Joe, 2015, Windrush '4'; and MAISEY, Jon, 2015, New Windrush gate. *Newsl. Gloucestershire Speleological Society* 2015 (1) (September 2015), pages 19–20.

300-foot shaft opens up in Cornwall garden

A deep mine shaft has appeared at Scorrier in Cornwall. The shaft opened up while surveyors were drilling into the patio of an empty house prior to its being sold. Since opening up, half a garage and the patio have disappeared into the hole. The shaft drops approximately 300 feet deep to water but could be four or five times deeper below that.

The shaft is a remnant of Cornwall's tin mining industry in the 18th century. Scorrier is in the area of the old Great North Downs Mines. As mines closed, many put very large blocks of timber, often old railway sleepers, across shafts and backfilled them, thinking this would be safe. Gradually all evidence of the engine houses and covered shafts disappeared from view and memory and in the past builders assumed there was nothing there. Had they consulted old maps they would have known about the shaft. The timbers rotted over the years and collapses like this often happen after long periods of rain, which they have had in this area.

Structural engineers are deciding the future of the house but the shaft will be recapped with concrete.

SOURCE: *BBC News – Cornwall*, 14 March 2016

Underground building-stone quarries near Nailsworth, Gloucestershire

Members who attended the excellent Cotswolds Study Weekend in 2015 will recall visiting the spacious Balls Green Lower quarry near Minchinhampton and Nailsworth, south of Stroud. Members of the Gloucestershire Speleological Society have reported on a number of other such sites in the neighbourhood where they hope to be allowed official access, these including the Balls Green Upper quarry, and others at Brimscombe and Amberley.

SOURCE: MAISEY, Jon, 2015, Prospecting for mines in the Nailsworth area. *Newsl. Gloucestershire Speleological Society* 2015 (1) (September 2015), 23–24.

All change at Boulby potash mine near Saltburn-by-the-Sea

Boulby potash mine, on the east coast a few miles south of Saltburn, North Yorkshire, is the UK's deepest operating mine, and employs more than a thousand men working underground or at the surface processing plant. The two shafts are about a kilometre deep, and mine galleries

have been driven over ten kilometres out under the North Sea. The potash (potassium chloride) is used primarily in agricultural fertilisers, much of it being exported by ship from Teesside. Rock salt (sodium chloride) is also mined, and used for de-icing roads.

The owners of the mine, Israel Chemicals, have announced proposed changes in production, with a reduced potash output, and development of mined polysulphate (a mixed salt of potassium and chemically related metals). Geological factors have made continued potash extraction decreasingly economically viable, and it is said that as a fertilizer polysulphate is more environmentally friendly.

The change will mean the loss of about a quarter of the jobs at the mine, a serious blow for an area which already has high unemployment. Some 2,200 steelworkers at nearby Redcar lost their jobs recently on the closure of the SSI works there. It is planned to cease mining potash by 2018.

Polysulphate output is to be increased from 200,000 tonnes per annum to 1,000,000 tonnes in 2020. Recent production had been of the order of 1,000,000 tons of potash and 500,000 tonnes of rock salt annually. There are currently plans by another company to open a new potash mine further south, near Whitby.

SOURCE: FARRELL, Sean, 2015, Hundreds of jobs to go as only UK potash mine winds down production. *The Guardian,* 13 November 2015, page 32.

England's first oil field, Derbyshire

England is, or more accurately once was, possessed of great underground wealth. 'Was', of course, because our metal ores are now largely exhausted and mines closed. Copper and iron and the like are more cheaply won elsewhere, the same being true of coal. But in Edwardian times the UK government was not aware of any significant home oil reserves, our requirements being met by imports from the British Empire. Nevertheless, in 1911 Winston Leonard Spencer Churchill [1874–1965], who was at the age of 36 appointed First Lord of the Admiralty, decided to convert the Royal Navy from coal-burning to oil-fuelled ships, although we still had at that time immense onshore coal reserves and a great many productive coal mines.

On the outbreak of war with Germany in 1914, of course, oil tankers heading for the British Isles were at serious risk of attack from enemy submarines. In 1915 the British Government commissioned S. Pearson & Sons to search for onshore oil reserves. Three geologically promising districts were identified. These were the Lothians to the west of Edinburgh, the Potteries of Staffordshire, and the Derbyshire coalfield. Eleven exploratory wells were authorised, of which seven were in Derbyshire.

Drilling expertise had to be brought in from the United States, which by then had producing oil wells. The first site investigated was Hardstoft near Tibshelf between Derby and Sheffield, on land the property of the Duke of Devonshire. Negotiations for contracts to drill at that location were not concluded until 10 September 1918 by which time, of course, the war was nearly over. The Hardstoft No.1 well was eventually commenced on 15 October 1918. Oil was found in the Carboniferous Limestone at a depth of 3,070 feet on 27 May 1919. Extraction commenced on 7 June later that year. By December 1927 the well had yielded 20,000 barrels of oil, at an average rate of six or seven barrels a day.

This had all been authorised during the war under the Defence of the Realm Act, which was of course repealed after victory in 1918. The land and the mineral rights remained in the possession of the Duke of Devonshire, and the present Duke continues to own the only privately owned UK oil extraction licence. This, Britain's first oil producing well, still exists along with the concrete base for the pump jack and a storage tank, carefully preserved at a garden centre (the Oilwell Nursery) on the outskirts of Tibshelf village. The Geological Society of London plans to celebrate the 100th anniversary of British oil production (in May 2019) starting with a conference on the 'European Oil and Gas Industry History' in London in March 2016.

SOURCE: CRAIG, Jonathan, et al., 2016, Hardstoft: Britain's first oil field. *Geoscientist* 26(2), 12–17.

NAMHO 2016 to be based in Dublin and 2017 to be in South East England

NAMHO, the National Association of Mining History Organisations, is an 'umbrella' group of which Subterranea Britannica is a member. Paul Sowan is the SB representative who usually attends NAMHO committee meetings which are held at various places something like three times a year in, for example, Cumbria, Derbyshire, Shropshire, Somerset or Yorkshire.

An annual conference at which individual members of all member societies meet is usually based in a mining area somewhere in the British Isles. The 2016 conference is provisionally scheduled for 17 – 19 June, based in Dublin. The Surrey-based Wealden Cave and Mine Society will host the 2017 NAMHO conference and field visits weekend in east Surrey. WCMS is a caving club many members of which devote a great deal of their time to underground sites, especially mines of various kinds, in east Surrey, so very much within Subterranea Britannica's field of interests.

Members of member societies organise the weekends, and offer surface and underground field visits ranging from very easy to challenging, and a programme of talks. Accommodation is usually at a field studies centre or similar, and there is also usually a camping option for the hardy. In 2005, for example, when WCMS last organised a NAMHO weekend, we were based at the Juniper Hall Field Centre near Dorking, with those opting for camping accommodated nearby at Brockham.

Underground visits in 2005 included walk-around tours of Reigate 'caves' (town-centre silver-sand mines which have had numerous secondary uses) and a number of building-stone quarries and hearthstone mines. Surface walks included above-ground tours of mining landscapes such as at the Betchworth and Brockham lime-works, the Merstham Gap, and Godstone. Most sites are in the so-called Vale of Holmesdale, at the foot of the North Downs escarpment, a designated Area of Outstanding Natural Beauty. Watch out for more news of the 2017 event in future issues of *Subterranea*.

Peak District mines: observations and discoveries, Derbyshire and Staffordshire

John Barnatt, amongst the UK's most highly regarded mining archaeologists and historians, and other members of the Peak District Mines Historical Society, have published the latest of a long-running series of archaeological reports on mines in Derbyshire and Staffordshire. Three mines are featured. At Mixon mine in Staffordshire (SK 046573) it is reported that archival research has brought to light accounts for the production of copper ore in the years 1777–1781. From 1779 to 1781 some 21 tons of ore were mined, the sale of which yielded just over £216. However, the overall loss sustained by the enterprise for the five years 1777–81 was about £318, so it appears that mining costs exceeded sales income.

Surface and underground workings at Slate Scrin at Castleton, Derbyshire (SK 14167 82418) have been examined. A 'scrin' is a very narrow vein of ore, and the source worked opencast and underground at this location is poorly documented. One John Slate is known to have mined nearby in 1798–1814. Currently access underground is through a narrow vertical slot 'high up near the summit of Cowlow Nick' overlooking Castleton. A high stope (worked-out vein) is pictured in the report.

On the mine floor, non-metalliferous 'gangue' or valueless vein mineral fragments are noted, including purple fluorite (calcium fluoride). Mining features surveyed and recorded include shotholes bored vertically downwards, stemple sockets in the walls and some surviving wooden stemples (supports for false floors), and a false floor. Part of the vein worked is clearly visible, with parallel layers (from the margins inwards) of clear yellow fluorite, baryte (barium sulphate), and 'brilliant' blue-mauve fluorite running down the centre. 'Tiny traces of galena remaining in the vein suggest somewhat desperate measures were afoot in what was presumably a rapidly dwindling orebody, although how much ore was obtained from the worked-out areas is not known'. The report discusses unresolved suggestions concerning the mine's possibly several entrances and the possibility of lower-level but at present inaccessible workings.

Further archival research relates to the Cadman Crew mine in Chelmorton Liberty (SK 1048 7126), for which accounts for 1754–1760 have been located. The site of this mine, previously not precisely known, has been determined. Manuscript sources pinpoint the location, and still-visible field evidence close to the identified location is reported, including a 50-yards adit (mine access tunnel) in which a mineral vein can be seen. This mine adit has previously been known and published as the 'Three Js Cave', or 'Deep Dale Trial Level'.

SOURCE: BARNATT, John, et al., 2015 Peak District Mines, Observations and Discoveries – Part 54. *Newsletter Peak District Mines Historical Society* 156 (October 2015), 6–9.

Rubbish or important archaeological evidence at a recent but now abandoned fluorite mine at Stoney Middleton, Derbyshire

The Hanging Flat mine (SK 2063 7601) was commenced and worked for fluorite (calcium fluoride) in the 1970s–1980. Exploration underground is not recommended, as much of the country rock has collapsed into the tunnels, and false floors are reported as looking likely to collapse without warning! Archaeological features survive on in-situ rock surfaces, such as high-explosive shotholes, and rotting timber pit props. Signs and traces of subsurface tramways survive. A project to remove 'rubbish' from the mine is reported, but it was decided that much of this was material left underground by the miners, not extraneous items brought in by post-closure visitors.

The pipe on the left is clearly from the later fluorite working. Photo Paul Powers

Much of the material is, to contemporary eyes, unsightly, but nevertheless represents evidence for how this mine was worked around 40 years ago. Noted are, for example, iron pipes for compressed air supplies for rock drills, a small compressor tank, large-diameter brown plastic pipe, electric cable and two light bulbs, plastic oil containers, rags, and possible two-strand plastic-coated electric detonator wire. There are also relics left as a result of a post-closure television filming exercise, featuring a mock mine rescue practice, including some polystyrene 'boulders'. It was decided that the mining-related material, and the 'boulders', should be left underground as archaeological evidence for the future.

SOURCE: BARNATT, John, 2015, To clean or not to clean: Hanging Flat mine, Stoney Middleton Dale, Derbyshire. *Newsletter Peak District Mines Historical Society* 156 (October 2015), 9–10.

Miners' graffiti, Speedwell mine, Castleton, Derbyshire

Numerous graffiti, some made by miners and some by visitors, have been recorded in Speedwell mine near Castleton. Access into this mine is somewhat unusual, being made by boat on an underground canal. Driving the tunnel for this commenced in 1771, but as little ore was found the mine closed in 1794, with brief subsequent periods of small-scale working in 1802–14 and 1844–47. By 1802 there was a visitor guide living on site, and this has in effect been an expensively created popular tourist attraction from the early 19th century to the present day. The recorded 18th- and 19th-century graffiti are reviewed, with some attempts to distinguish miners' and visitors' initials and names, and to suggest the possible identities of some of the people who wrote on the walls.

SOURCE: BARNATT, John, 2015, Miners' graffiti, Speedwell mine, Castleton, SK 1392 8274. *Newsl. Peak District Mines Historical Society* 155, page 4.

Repairs to the shaft access to the Whalf-Hillock-Knotlow mine complex, Derbyshire

A pack wall in a shaft access to Whalf mine was observed in 2014 to appear to be in danger of collapsing, and has been stabilised. Entry via a hole in the floor of a ruined miners' coe (hut) gives access to a stone-lined shaft which descends into a large stope (worked out ore vein) with dry stone pack walls of waste rock at each end. Whatever had supported one of these walls had collapsed, leaving the loosely stacked rock hanging over a void below. Scaffolding pole stemples (supports) and steel mesh have been emplaced to prevent the collapse of the loose rock.

Alan Brentnall cautions that 'stopes and their stacks were never designed to be permanent or safe, and we all need to be aware of the possible dangers'. Miners stacked waste rock to be safe for as long as the part of the mine they were working in remained in use, not for ever. Especially where wooden supports were employed to hold up stacked waste rock, they may well have rotted in the centuries after mining ceased.

SOURCE: BRENTNALL, Alan, 2015, Whalf shaft repair. *Descent* 246, page 9.

Collapse of a street into old mine workings, Newcastle-on-Tyne

Residents of Craster Square, Coxlodge, in the Gosforth district of Newcastle-on-Tyne were shocked by the sudden collapse of the road close to their houses into a 20ft-deep crater. It was known, at least by those taking an interest in the history of the area, that there had been pit yards and a capped shaft in the neighbourhood.

SOURCE: ANON, 2015, Collapse reveals mine workings under street. *The Guardian,* 13 November 2015, page 18.

Dinas silica mines ownership changes hands but access remains

Ownership of the well-known Dinas silica mines in South Wales has been transferred to Natural Amenities Ltd, without restrictions of access. This pillar-and-stall complex is in quite steeply dipping beds of quartzite, and yielded large volumes of material for use in refractories. The upper part of the mine provides an unchallenging and safe introduction to persons going underground for the first time, and the down-dip flooded area is a safe location for cave diving training. The operators of this mine were once one of the world's largest producers of silica rock for fire bricks and the like.

SOURCE: FARR, Martyn, 2015, Silica mines ownership. *Descent* 246, page 12.

An unfortunate event at the abandoned Gold King gold mine, Colorado, USA

Personnel of the US Environmental Protection Agency are reported to have accidentally disturbed a dam and released three million gallons of bright orange toxic waste into the Animas River, something of a tourist attraction further down the valley. A state of emergency has been declared at several downstream townships, and it is supposed that lawyers will be kept lucratively busy pursuing claims.

In that connection, it has been observed that the Animas was already contaminated, if not in quite such a colourful way, as a result of heavy metal contamination from some 400 mines in the catchment area. The question has been posed; will the EPA be prosecuting itself?

There have been similar escapes of polluted water at a number of British mines, such as at the Magpie mine sough in Derbyshire, and Parys Mountain on Anglesey. The orange discolouration at such events is probably hydrated iron oxides (the same chemical compound as common-or-garden rust), a relatively harmless material. In the minewater context it results from the oxidation and hydrolysis of the mineral iron pyrites (iron II disulphide). It is the non-visible part of the pollution, sulphurous and sulphuric acids, that is the greater environmental threat. One of the best and most accessible British locations where bright red minewater can be seen is at Worsley, west of Manchester, where iron-laden acidic water can be seen leaking from several miles of old coal-mining tunnels.

SOURCE: JONES, Chris, 2015, Now it's orange… *Descent* 246, page 33 with additional information.

Unfortunate event at a Louisiana salt mine, USA

It is generally well-known that DIY people drilling holes in walls when putting up bookshelves need to exercise due care and attention and, yes, a risk assessment. The same applies to drilling holes in the ground. Property developers' drills have punctured the ceilings of underground railway tunnels in London and Moscow in recent years! Here is another cautionary tale, this time from the USA.

The approximately 10 feet deep Lake Peigneur in southern Louisiana lies above a rock salt mine. In 1980 the Diamond Salt Company / Texaco drilled a 14-inch-diameter borehole into the underlying rocksalt. Unfortunately the borehole was off-course by about 30 feet and penetrated one of the mine galleries, creating a rather bigger plughole than you have in the kitchen sink!

Fresh water poured into the mine and started dissolving the rocksalt. Fifty-five miners managed to escape and throughout the rather exciting incident there was, remarkably, no loss of life. The drilling crew scrambled off the toppling rig and escaped the whirlpool of water cascading down the borehole. The 14-inch borehole was widened by the flow to a sinkhole over 2,500 feet across, and two drilling rigs, a tug boat, and 11 barges, along with the lake, vanished within three hours.

The lake refilled within 24 hours, via a 150 ft waterfall down the shaft, tapping a nearby salt-water canal and reversing its direction of flow. While it lasted, this was the highest waterfall ever recorded in the history of the state. Some days later, nine of the barges reappeared as the lake refilled, and a fountain of water erupted from the mine.

It is worth adding that, yes, those persons met by your scribe who directed exploratory sea-bed boreholes for the Channel Tunnel assured him that they did take great care to drill some way to either side of where the tunnellers would pass below.

SOURCE: JACKSON, Chris, 2015, The rock that wouldn't stay still: an introduction to salt. *Geologists' Association Newsletter* 14 (4), page 11.

Visit for HRH Prince Edward, Earl of Wessex, to the South Street Caves, Dorking, Surrey

Richard Curtis (Dick) Selley of the Mole Valley Geological Society generated some local publicity for the Society and for Dorking's underground visitor attraction by escorting HRH Prince Edward, Earl of Wessex, on a guided tour of the South Street 'caves' in March 2015. This is not of course a natural cave, but seems best interpreted as part rock-cut wine cellars, and part subterranean folly. Although dug in the Folkestone Sand of the Lower Greensand, as are the 'caves' (glass sand mines) in neighbouring Reigate, this site is quite unlike the Reigate 'Caves' which are opened to the public five Saturdays each year by the Wealden Cave and Mine Society.

The Reigate mines open to the public offer a more or less level walking route, with a few gentle slopes and short flights of steps, all more or less on one level. The Dorking 'caves' descend to a considerable depth by way of a rock-cut helical staircase associated with a well shaft, terminating in an enigmatic rock-cut chamber at the bottom which, it has been suggested, may have been created to accommodate cock-fighting, or may just have been a flight of whimsy. For public access details for the South Street 'caves', contact Dorking Museum.

SOURCE: HILL, Claire, 2015, Field meeting report: the first ever Royal geology field trip, 14 March 2015. *Geologists'* Association Magazine, 14(2), page 15.

NEWS – MISCELLANEOUS

Subsidence at St Albans, Hertfordshire

Early in the morning of 1 October 2015 a 'dramatic and very large sinkhole' appeared in the carriageway and footpath of Fontmell Close, St Albans, affecting also a part of at least one front garden. The crater was around 20 metres across and ten metres deep, so a considerable volume of material had disappeared downwards. Whether 'sink hole' was the appropriate term in this context is debatable, as this word is generally reserved for natural events where surface material has subsided into a natural cave produced by percolating rainwater dissolving chalk or some harder limestone. This may possibly have been a crown hole collapse, the surface material subsiding into a man-made cavity such as a mine, tunnel, or well. As St Albans is largely built on London Clay, neither mechanism seems to fit the geological context.

Another scenario is a cavity washed out of unconsolidated soil by a major leak from a large water main or sewer. Subsidences, generally smaller than that at Fontmell Close, also result from differential subsidence where an open pit has been landfilled. As material dumped in the pit rots and is compacted the land surface sinks relative to solid ground nearby. According to David Kennett, the modern housing at and around Fontmell Close, once known as Bernard's Heath, was the location of clay pits dug by brickmakers in the 19th or early 20th centuries. The underlying chalk at this location is probably at too great a depth for this event to have related to a brick-field-related chalk mine.

A geophysical survey was commissioned to attempt to determine if there is a risk of further ground collapses. Meanwhile, the hole has been filled with 18 lorry loads of concrete (about 700 tonnes). However, further cracks have appeared in the nearby road surface. By the end of November the cost of investigations and immediate remediation was stated to be £40,000.

SOURCE: KENNETT, David H., 2016, Hidden landscapes of brick: the sinkhole in St Albans. *British Brick Society Information* 132, page 2, with additional comment.

Townhouse mega-basement opposed in Chelsea, London

The owners of a '£4 million townhouse' in Walton Street, Chelsea, have applied for planning permission for a mega-basement including a gymnasium and a playroom under their three-storey property.

The proposal is opposed by residents of this shopping street, and by the owners of the nearby Enterprise bar and restaurant, reportedly a favourite resort of celebrities. Developments of this kind are generally unpopular with neighbours for two reasons: potential risk of damage resulting from subsidence or collapse into inadequately supported excavations, and months of disruption caused by delivery of building materials and removal of many skips full of excavated material.

SOURCE: WATTS, Matt, *Evening Standard*, 18 February 2016.

Developments at the Crystal Palace High-Level Station Subway, London

There have been two railway stations serving the former Crystal Palace as re-erected in an enlarged form in 1854 at Sydenham, relocated from its original 1851 location in Hyde Park. The huge iron and glass structure with its associated gardens was for the rest of the nineteenth century an immensely popular tourist attraction, but was destroyed by fire in November 1936.

The Palace was served at first by what became known as the Crystal Palace Low Level station, part way up Anerley Hill: this is still operational. Later, a High Level Station was opened on the west side of Crystal Palace Parade. The loss of the Palace effectively made the second station (a terminus) redundant, although High Level was not closed until the 1950s. Both stations were architecturally imposing, but the most striking surviving feature of High Level survives albeit out of sight below Crystal Palace Parade.

First-class ticket holders were provided with an exclusive and very ornate subway direct from the London end of the station to the main entrance to the Palace. This subway and its history was fully described in *Subterranea* 36 (August 2014). Unlike the great majority of station subways this is spaciously proportioned with a tiled floor and octagonal masonry columns supporting a vaulted polychrome brick ceiling.

Visitors in the subway during Open House 2015.
Photo from Friends of Crystal Palace Subway

The Friends of the Crystal Palace Subway have secured funding to allow public access to this spectacular subterranean space. It is a complication that the two ends of the subway are in two different London Boroughs, calling for parallel discussions with their planning officers. The current proposal is to re-establish a public entrance on the west side of Crystal Palace Parade (A 212) in the London Borough of Southwark. At present the eastern entrance from Crystal Palace Park in the London Borough of Bromley is the more interesting to view, as flights of steps down to polychrome brick arches can be seen though perimeter fencing.

The Friends have already received support from the Heritage Lottery Fund (£10,000) to research the site and the London Borough of Southwark (more than £11,000). Planning permission has been granted by Southwark for a new gate and handrails from the former station site. Although an entrance from the Park would be a great deal more impressive and publicly accessible, it seems likely that creating a secure entrance on the east side would be much more expensive. Further funds have come from Antic London and Acacia Learning (£5,000 each), as well as £2,000 from online crowd-funding. Another £30,000 is needed. Donations are invited via www.gofundme.com/cpsubway

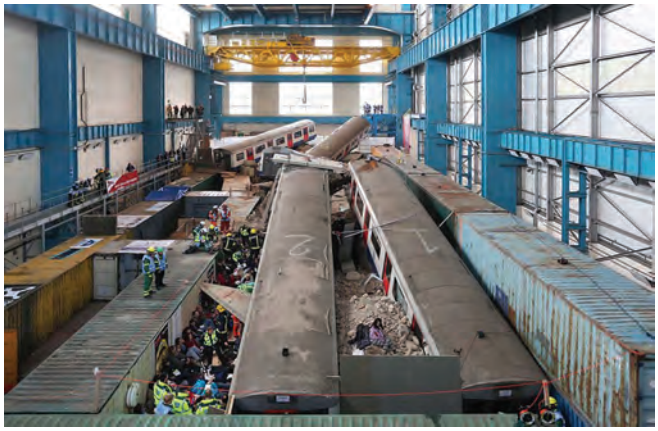
SOURCE: Samantha BOOTH, 2016, Underground pathway had palace sitting on top of it. *Croydon Advertiser,* 15 January 2016, page 12 [Note: the public road, not the site of the Palace building, lies above the subway].

Tower 'collapses into Tube station' during Europe's biggest disaster training drill

In the first week of March this year, emergency crews in London took part in the biggest disaster training exercise ever seen in Europe at a specially constructed 'scene' simulating a high-rise tower block under renovation falling into Waterloo underground station to prepare emergency crews for a large-scale operation with mass casualties.

More than 250 personnel worked at the scene and in a specially constructed temporary mortuary during the four-day exercise at the disused Littlebrook power station in Dartford, Kent. Here a mock-up tube station was created and seven carriages upturned in the rubble, and 600 'injured' being led out of tunnels to safety.

The four-day exercise, 'Unified Response', which has taken more than a year to plan, was coordinated by the London Fire Brigade working with more than 70 partner agencies including London Ambulance Service, local councils, utility companies, specialist search and rescue teams, and the Government's Cobra committee to respond to the 'disaster'. Disaster victim identification teams from all UK police regions worked alongside other forensic specialists.



The £770,000 drill was funded by European Union money; officers from Interpol and police from EU countries including France and Germany were present. It was the largest-ever training exercise in the 150-year history of the London Fire Brigade.

SOURCES: *Evening Standard* and *The Guardian*, 29 February 2016

Dewstow Gardens and grottoes near Caerwent

Dewstow Gardens, near Caerwent and Chepstow, date from about 1895 but fell into disuse and were derelict after World War II until they were restored as a visitor attraction (www.dewstowgardens.co.uk) in 2000. They are reportedly 'well worth a visit' for those interested in subterranean garden features. The grottoes consist of 'various tunnels and chambers complete with pools, ferns, statues and mock cave formations'. The cited article includes four colour photographs. Clearly a good adventure trip for your younger children (or elderly members).

SOURCE: ANON, 2015, 'Underground' with a difference. *Newsl. Gloucestershire Speleological Society* 2015 (1) (September 2015), 29–30.

Rock-cut 'cave' (and house) for sale at Bridgnorth, Shropshire

The purchasers of a two-bedroom terrace house in Bridgnorth, Shropshire, will find themselves also in possession of a sandstone 'cave' which has been extended by a former occupier into a magnificently spacious cellar with a vaulted stone ceiling supported by half a dozen or so columns. The property is on sale for £200,000.

A description of the property in the Folly Society's magazine describes it as a terraced house with a 'secret cave and living rooms built out of a sandstone cliff'. The house was transformed in the 1980s and 1990s by a resident artist, Antony Dracup [c.1930–2002]. His excavation added 650 square feet of living space at the back of the original building. Vaulted ceilings, 24 pillars and a gothic archway are mentioned.

The house opens up into this huge cave with an impressive vaulted ceiling, which provides an extra 650 sq/ft of living space. The gothic archways were made using recycled sand from the excavation

Associated with the property is a 'near-vertical garden terrace' above the cave. Nock Deighton, local estate agents, reportedly have said that many houses in the town have rock-cut 'caves' behind or below them, but none so remarkable as Dracup's. The offer price is quoted as £199,950.

Website: http://antonydracup.weebly.com/

SOURCES: ANON, 2016, For sale: des res with added cave. *The Guardian*, 20 January 2016, page 4 [Photograph]; and ANON, 2016, Bridgnorth cave house. *Follies* 25(1)(96), page 7.

Essex couple tie the knot in a Cornish slate quarry

A couple have transformed an underground slate quarry in Cornwall into a beautiful alternative wedding venue with more than 500 twinkling candles. Bride and groom Micha, 27, and Phillip Trim, 36, from Romford, Essex, had to accessorise with hard hats and put up with lots of uninvited guests – in the form of a large population of bats. However they were determined to tie the knot in the picturesque Carnglaze Caverns, in the Loveny Valley, near the village of St Neot on the southern edge of Bodmin Moor.

The couple invited forty guests to the underground ceremony, all of whom had to wear hard hats to accompany their elegant outfits. The magical venue boasts a crystal clear lake, along with its unique wildlife. The bride wore her veil over a hard hat as she walked down 60 slate steps to reach the ceremony 200ft underground.

Carnglaze Caverns consists of three man-made caverns formed as part of a Carnglaze quarry. The first of the caverns, the Rum Store, is so called because it was used by the Royal Navy during the Second World War to store its supply of rum. In 2001 it was converted into an auditorium with seating for four hundred.

Carnglaze Caverns has hosted concerts by folk-rock artists such as Fish and Fairport Convention, as well as bands such as Embrace (in 2004), and British Sea Power (in 2005 and 2007), as well as hosting craft and mineral shows.

Carnglaze is Cornwall's only underground slate quarry and as such, played an important part in the mining heritage of Cornwall. The finely laminated, dark blue slate from Carnglaze was extensively used in South East Cornwall and further afield. Carnglaze is now included as part of the Cornish Mining World Heritage Site.

SOURCE: *Mail Online,* 28 January 2016.

Underground home in the Wyre Forest, Worcestershire

Retired businessman Angelo Mastropietro has converted a pre-existing 'dingy rock house' into a subterranean luxury home in the Wyre Forest, Worcestershire, by excavating 80 tons of rock. He bought the original cave for £62,000 in 2007 and has spent another £100,000 to produce a rock-cut dwelling with all mod cons including underfloor heating. The owner has pointed out that his surname means 'Master of the Stones'.

SOURCE: POLLARD, Chris, 2016, Now that's a real man cave. *The Sun*, 12 January 2016, page 11 [Photograph]

Friends of Williamson's Tunnels, Liverpool

It is always good to see evidence of underground archaeology being recognised by the mainstream archaeological community. Our longstanding and very good friends in Liverpool, the Friends of Williamson's Tunnels, are the latest society of underground archaeologists to be featured in the 'Odd Socs' page of the monthly archaeological magazine *Current Archaeology.*

This group explores, makes accessible to the public, interprets and celebrates the extraordinary burrowings of one Joseph Williamson at Edge Hill, a sandstone ridge to the east of and overlooking the city centre. Between 1805 and his death in 1844, Williamson (a 'millionaire tobacco merchant') employed workmen to dig holes underneath his properties in and around Mason Street. What the tunnels were intended for is not known for sure, but one theory is that this philanthropic gentleman simply wanted to provide the local unemployed with paid employment which he greatly preferred simply to handing out cash for nothing. His workmen retained the dignity of an honest day's work being rewarded with an honest day's pay.

Joseph Williamson

Williamson's legacy of seemingly purposeless tunnels and underground rooms became, after his death, convenient places for the disposal of domestic refuse, and demolition rubble. The 'Friends', a registered charity established in 1996, have been clearing out Williamson's tunnels which are splendid underground landscapes of neatly cut sandstone walls and fine brickwork arches and vaults for the benefit of the curious visiting public. Commendably, they do not simply put all the excavated 19th-century 'rubbish' into skips to go straight to landfill. The material is scrutinised with care and much once everyday domestic material is recovered for study: it throws light on Liverpudlians' lifestyles in the last two centuries.

Subterranea Britannica members have of course visited Edge Hill on a number of occasions, and remain in contact with this energetic group. The fame of Joseph Williamson is, at least in a small way, worldwide. Your scribe (PWS) for example once shared a platform with them at an international conference on underground archaeology at Starigrad Paklenica on the Adriatic coast of Croatia! And the Friends not so long ago hosted an international gathering attended by no fewer than almost a dozen of our friends from Ukraine. For up-to-date details of the Friends visit www.williamsontunnels.com

SOURCE: FRIENDS OF WILLIAMSON'S TUNNELS, 2016, The Friends of Williamson's tunnels. *Current Archaeology* 27(1) (313), page 50.

NEWS – PUBLICATIONS

Aqueducts and underground passages of Exeter, Devon

DETAILS: STOYLE, Mark, 2014, *Water in the city: the aqueducts and underground passages of Exeter.* University of Exeter Press: xx + 299pp [ISBN 978-0-85989-877-5]

Exeter has a complex of subterranean water supply tunnels of medieval and post-medieval date below the city streets. Parts of the system, which is of cut-and-cover construction, are open to the public. Water, conveyed in lead pipes laid along the tunnel floors, was piped to the cathedral and city centre from springs northeast of the centre, beyond the city walls. The narrow tunnels were created by digging and sometimes lining deep trenches in the underlying sandstone and roofing them over at ground level. This results in floor to ceiling heights of two or three metres or so in places, to allow uninterrupted gravitational flow.

This is an exceptionally well illustrated archaeological and historical record of a city water supply system unique in Britain. Numerous colour photographs record details of sub-surface stone work, and ten maps delineate the system of tunnels at various dates from c.1200 to 1836. Splendidly reproduced details from archival sources are also included. The overall result is a synthesis of archaeological recording and archival research. The text makes it clear that the city system described is not a continuation of a much earlier Roman conduit which had fallen into disuse by the Dark Ages. The quite distinct medieval system is now a well-established and popular visitor attraction, entered from a modern visitor centre.

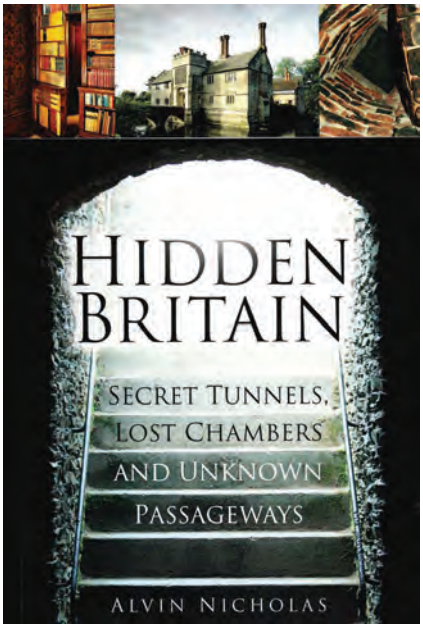
Hidden Britain

DETAILS: NICHOLAS, Alvin, 2015, *Hidden Britain: secret tunnels, lost chambers and unknown passages.* Stroud: The History Press: 192pp [ISBN 978-0-7509-5224-8] £12.99.

Review by Martin Dixon

Hidden Britain is a reference book of secret tunnels, chambers and passageways found in houses and castles across Great Britain. A great number of these are in old Catholic houses and often known as 'Priest Holes' for their intended function of hiding Roman Catholic clergy under seventeenth- and eighteenth-century Protestant rule. Few of these hidden spaces are large and some only big enough to securely store communion artefacts when open pursuit of the Catholic religion was a punishable offence.

Regarding Subterranea Britannica interests, the book recognises that the vast majority of 'secret' tunnels of this genre are either non-existent or a case of mistaken identification of mediaeval drains. The latter are interesting in their own right but evidence of their use for human concealment is rare. One category of tunnel that clearly does exist is that of sally ports – used to allow castle defenders to counterattack and to potentially provide a route for restocking with supplies. Sally ports at (for example) Edinburgh, Nottingham and Pembroke Castles are included but are not the main focus of the book.



The majority of the contents are given over to a gazetteer of sites – a surprising number now in the hands of the National Trust – which hold such secret spaces. Returning in a sense to Sub Brit's roots, the publication can be used to seek out such sites across the country. Chapters also include a more detailed description of Glamis Castle and a description of the escape of Charles II. Extensive references are included but the glossary of terms is padded out slightly by including terms such as *cellar* and *attic* alongside more specialist terms.

The index of Properties and Places attempts to distinguish buildings described in the text versus other locations but this doesn't add particular value (eg Nottingham Castle is categorised as a place that can be visited whereas the adjacent *Trip to Jerusalem* pub isn't). Some of the index leads to the reference pages which I found slightly clumsy. All in all it's a worthwhile book for the traveller interested in this period of British history but probably not worth investing in for its underground content alone.

Mining in Cornwall and Devon

DETAILS: BURT, Roger, Raymond BURNLEY, Michael GILL, and Alasdair NEILL, 2014, *Mining in Cornwall and Devon: mines and men.* University of Exeter Press: xx + 252pp + CD [ISBN 978-0-85989-889-8]

Roger Burt is an economic historian who has to his credit a series of published volumes devoted to the mining records of counties where the extraction of metalliferous ores has been important. Much of the data presented in this volume derives from the published UK Mineral Statistics from about 1850 to 1920. Information from other sources has been used in this book to present an economic history of the mines, mineral ownership and mine management in the southwest of England. An entire chapter is devoted to the Duchy of Cornwall's records,

and another to the records of mining companies.

This is not a work about minerals, mining geology or mining methods, but presents information on mineral production, mine owners and managers, and the numbers of men, women and children employed. There are 15 photographs, adequately reproduced, depicting surface views of abandoned mine sites and structures and three illustrating working conditions underground. The associated CD holds mine-by-mine data, as available, for the thousands of mines worked in the region from the late 1790s to the present day. A reprint of this title, the research for which was grant-aided by the Northern Mine Research Society, was issued in 2015.

NEWS – TUNNELS AND TUNNELLING

New Civil Engineer to be online from January 2016

The Institution of Civil Engineers' members' magazine, *New Civil Engineer,* has until December 2015 been published every one or two weeks for some decades. From January 2016 the magazine is to be published online, with a monthly paper issue. Subterranea Britannica members will know that *NCE* has been an excellent source of up-to-date and authoritative news of new subsurface works.

4th terror tunnel found beneath the border of India and Pakistan

Soldiers from the Border Security Force (BSF) who were clearing an area of wild grass in the state of Jammu and Kashmir in northern India have stumbled on a 30-foot tunnel running through the international border.

The timber-lined tunnel, which is 3 x 4 feet in size and 10 feet deep, was concealed under elephant grass at Jammu's RS Pura sector near a post called Allah Mai De Kothey. The tunnel ran right below the border fence put up to prevent infiltration into Indian territory. It was not complete as it had not been opened into the Indian territory and finished a little short of the barbed wire fencing.

It appears that a big terrorist attack was being planned and the tunnel would have been used for infiltration by terrorists and transportation of arms and ammunition from the Pakistan side into Jammu City. The BSF has recorded its protest with Pakistan.

The BSF first detected the tunnel as part of its 'anti-tunnelling measures' in the area. The BSF had been using earth-moving machines and had noticed a 'fox cavity'. The anti-tunnelling measures had been initiated at the beginning of March 2016, as the BSF had received intelligence about terrorist movement on the Pakistani side of the border.

Two tunnels were detected in Akhnoor sector in 2012 and 2014; and in 2013 a sophisticated 400-metre tunnel with ventilation pipes was discovered in the Samba sector. Army and police installations along the Jammu-Pathakot national highway have been the main target of terrorists in Samba and Kathua districts for some years now. During the terror attack at the Pathankot air base in January this year, more than six security personnel were killed in an attack by six terrorists, who were later killed by NSG commandos.

SOURCE: *Indian Express,* 4 March 2016.

Another borehole penetrates a tube train tunnel, west London

Holes drilled by surface site contractors in major cities (both London and Moscow in recent years) have been known to penetrate urban metro tunnels, a potentially very dangerous event. The latest instance has been reported on London's Central line near White City. A crowded westbound rush-hour tube train approaching White City was halted on 22 February after it was showered with lumps of masonry 'as big as rugby balls'.

The line was closed between Marble Arch and Shepherd's Bush for three hours from 17.30 as the hole in the tunnel roof was repaired and debris was cleared from the track. The hole was bored from a building site under development as an extension to the Westfield shopping centre. It breached the tube tunnel roof at a depth of about 100 metres.

SOURCE: WATTS, Matt, 2016, Masonry falls on tube train. *The Evening Standard,* 23 February 2016, page 6.

Brighton's Royal Pavilion tunnel open for the first time

Tours of the Brighton Royal Pavilion's basement and famous tunnel started on 25 February 2016. For the first time visitors will get a rare glimpse of how King George IV made the short trek across his estate to royal stables – now the Brighton Dome – so he could see his beloved horses, away from the prying eyes of passers-by. It is often thought he used the passageway to meet illegal wife Maria Fitzherbert, but the tunnel was actually built in 1821, long after their relationship had ended.

The 45-minute journey through the palace's underground network will offer a behind-the-scenes window into life below stairs for servants, from the rat catcher to the king's principal private secretary.

Organisers have warned that parts of the tour are dimly lit, there are low ceilings and uneven floors and some areas could be subject to alterations and cancellations at the last minute. This will be the first time the tunnel has been open to the public, having undergone recent

The Royal Pavilion tunnel in 1995. Photo Nick Catford

restoration to prepare it for public access. The basement tour ends with a visit to the tunnel.

The tours, which had to be booked in advance, run on three days a week until the end of March and cost £10. They were quickly sold out and at the time of writing (February) further dates have not been announced.

SOURCE: *Brighton Argus*, 9 December 2015

Tunnelling slope-shafts uphill at Crossrail stations in London

The inclined shafts in which London Underground's escalators run are mostly excavated in London Clay (a good tunnelling medium) or in consolidated loose gravel (tricky). Hitherto these have been excavated from top to bottom; all spoil being lifted to the surface with precautions against any of it tumbling back down on the excavators' heads. Such a method has of course been used by well-sinkers for many centuries, there being no bottom-upwards option.

The creation of London Crossrail in recent years has seen the excavation of running tunnels and their enlargement where required as station platform tunnels in advance of surface works and subsurface station passageways and lift shafts. At Liverpool Street and Whitechapel Crossrail stations, the bottom-upwards approach has been used by contractor BBMV Crossrail. The shafts, inclined at 30 degrees to the horizontal, are excavated uphill using a combined digger, operator's cabin, and shotcrete spraying attachment.

This ingenious device advances up the shaft as it is extended and lined by simultaneously erecting an overhead rail from which it is suspended. This method allows more efficient phasing of all subterranean operations in and around the sub-surface station tunnels and shafts.

SOURCE: ANON, 2016, Product innovation award – civil engineering. INSTITUTION OF CIVIL ENGINEERS, 2015, *British Construction Industry Awards 2015,* page 25 [Supplement to *New Civil Engineer*]

More than 70 ISIS escape tunnels discovered in the town of Sinjar in Iraq

A deep network of underground tunnels has been uncovered in Iraq, revealing how ISIS have been carefully maintaining escape routes for its fighters as they try to avoid coalition airstrikes.

The tunnels were discovered by Kurdish forces when the Peshmerga managed to retake the Yazidi majority town of Sinjar last December. Burrowing deep into the ground, some of the chambers are thought to be 30 feet deep, allowing ISIS fighters to hide out and move freely out of the way of airstrikes.

Although 70 tunnels have been uncovered, Kurdish and Iraqi forces remain concerned that more secret layers may have been constructed in other parts of the town. ' There is a tunnel under every alley, street and public building that remains intact,' Wais Faiq, head of Sinjar town council has claimed.

ISIS have dug so many to the extent that they completely destroyed the infrastructure of Sinjar. The tunnels remain in a precarious state with concerns remaining that parts of the labyrinth of corridors may have been rigged with explosives. The discovery was made more surprising when soldiers investigating the tunnels found that ISIS had even wired the chambers with electricity.

SOURCE: *MailOnline,* 4 March 2016.

New Farnworth rail tunnel opened on the line from Manchester to Bolton, Greater Manchester

Electrification of the Manchester to Bolton line required the replacement of the original two single-track bores at Farnworth, the tunnels having insufficient clearance for overhead wires. A photograph of the view through the newly opened short single-bore double-track tunnel includes the portal of the retained but now redundant single-track tunnel. The second older bore has, effectively, been widened to take two lines and attendant electrification installations.

Trains commenced running through the new tunnel on 14 December 2015. All associated work to remove temporary track was completed in January 2016. Electrification of the line is scheduled for completion by December 2017, allowing electric services direct from Manchester to Preston via Bolton.

SOURCE: MILES, Tony, 2016. Farnworth tunnel reopens. *Modern Railways* 73 (809), page 21 and (810), page 22.

Moseley Green railway tunnel, Forest of Dean, Gloucestershire

An illustrated account of this disused single-track 503 yards rail tunnel has been published. The two photographs are of a locked door at one portal, and an internal support framework where the tunnel passes under the Yorkley Road. Liaison with a keyholder is needed for a visit. The tunnel was reportedly used as an ammunition store from April 1942 to December 1943, and was closed to rail traffic on 13 March 1951.

SOURCE: BROWN, Rachel, 2015, A 'bimble' in the Forest of Dean. *Newsl. Gloucestershire Speleological Society* 2015 (1) (September 2015), 26–28.

Possible new and reused tunnels for a second main rail line from Brighton to London

The existing main London to Brighton rail line, opened throughout in 1841, is now used to capacity, with little realistic scope for carrying additional traffic. Of the three long single-bore double-track tunnels on the route, only that at Merstham has had a second parallel bore, driven in 1896–99. Although stretches of the line have been widened to four tracks where feasible, the Balcombe and Clayton tunnels, as also the Ouse Valley viaduct, form bottlenecks.

A former alternative route to the east via Lewes and Oxted was severed in the 1960s by the Beeching cuts, the lines between Lewes and Uckfield being closed. This route was in any case less than satisfactory, as trains northwards from Brighton had to reverse at Lewes. There has been a long-running campaign for the reinstatement of BML2 (Brighton Main Line 2) to ease congestion on BML1.

BML2 would avoid reversing trains at Lewes by boring a second tunnel under the town from near Falmer (by-passing Lewes town centre) to form a direct link to the closed line to Uckfield, north of which the line (singled by Beeching) would be restored to two lines of track. Trains thence, bypassing Haywards Heath and Gatwick Airport, would run via Oxted and the existing Oxted tunnel to the former Selsdon station in South Croydon, and then follow the former Woodside & South Croydon Railway to the sometime so-called Mid-Kent Railway at Elmers End and then on to Stratford, also providing a route through to Stansted Airport.

There are several tunnel-related problems north of Selsdon, as much of the track to Elmers End including the three short tunnels under Park Hill (east of Croydon town centre) is now used by Croydon's modern electric trams. How fast mainline trains could slot into the tram services running every six minutes or two is an interesting question! Further north, a new tunnel from Lewisham to Stratford is called for, so adding yet another under-Thames crossing.

The BML2 proposal looks rather expensive, and likely to face much opposition in South Croydon, as was the case in the 1970s when a suggested Channel Tunnel Rail Link via Oxted was put forward with a portal to a new tunnel under Croydon and south London sited in allotments.

SOURCE: ANDERSON, Elizabeth, 2015, Rail link to boost economy and solve airport problem. *Railwatch* 146, page 7.

Possible smugglers tunnel found at New Quay in Wales

A mystery tunnel has been found beneath a shop in New Quay, Dyfed. It's thought the tunnel under New Quay's *Ocean Blue* newsagents shop could have been used as a secret supply route for contraband. The owner of the shop, David Edwards, made the discovery after his basement store room flooded.

During a clean-up of the basement after the flooding, the removal of an old blocked doorway and debris led Mr Edwards to the underground passage. It leads towards the beach, where contraband, wines and spirits were once stored and traded in caves. In some places the tunnel is more than nine feet in height. It has been hewn along a rock face spanning at least 50ft along the back side of the shop building, heading towards the beach, but then reaches a blockage.

Despite suggestions that it is nothing more than a drainage system, David Edwards claims he was told about the 'secret tunnel' as a child. It could have been used in the 17th and 18th centuries, when the trade of illegal goods such as wine and spirits was rife along Cardigan Bay. Many local people were involved in illegal trades. In August 1704, after three ships had arrived with salt on board, custom officials found 150 men with horses on the beach loading contraband.

SOURCE: *BBC News – mid Wales*, 11 February 2016 and *Wales Online*, 24 February 2016.

Ground heat exchanger tunnels

As members are undoubtedly aware, it always feels cooler underground in the summer, and warmer on freezing cold days in the winter. In fact in systems of tunnels at shallow depth, such as the underground building-stone quarries in east Surrey, it is a constant 14º Celsius throughout the year. This temperature seasonal differential can be exploited in surface buildings by circulating air or water between the building and pipes or air ducts at shallow

depths, a few metres down. So here is a novel class of tunnel for intrepid sub-Britters to explore!

SOURCE: BUSBY, Jon, 2015, UK shallow ground temperatures for ground coupled heat exchangers. *Quarterly Journal of Engineering Geology and Hydrogeology* 48 (3/4), 248–260.

More on the Wookey Hole Caves by-pass tunnel, Somerset

The new tunnel allowing public access to chamber 20 at Wookey Hole Caves was noticed in *Subterranea* 40 (December 2015), pages 21–22. Some further details have now been published.

Chamber 20 (first reached in 1970) has hitherto been accessible only by cave divers swimming through a 145-metre sump (flooded to the cave ceiling) at depths of up to 21 metres. That route has now been bypassed for the convenience of tourists, and most of the rest of us non-cave-divers, via the new 74-metre tunnel link from chamber 9.

The new tunnel intersects one of the intervening chambers (chamber 10) on a bridge at high level, from which visitors can view the floodlit 10-metre drop to water below. This new route was opened to the public within a week of completion of tunnelling. The cited sources present a number of views of the tunnelling in progress and as completed, and a film of the operation has been made. A trailer for the film can be seen at http://tinyurl.com/WookeyTrailer

SOURCES: GRASS, Martin, 2015, Wookey's new tunnel. *Descent* 246, page 16; and PRICE, Duncan, 2015, Operation twenty: staying dry in Wookey's inner chamber. *Descent* 246, 24–26.

Cityringen metro tunnels at Copenhagen, Denmark

Construction of a new driverless train metro system for Copenhagen including 16.5 kilometres of new twin-bore tunnels commenced in 2011 and is scheduled to be completed in 2018. There will be 17 stations, and interchanges with five other stations on the two existing metro lines.

Cityringen, at a depth of 40 metres below the streets, will as the name indicates be a circular route around the city centre. The new line is being driven below congested inner urban areas and is being closely monitored for potentially adverse effects on buildings above and close to it. The tunnel-boring machines (TBMs) are being driven through bryozoan limestone (fossiliferous chalk) and in some places sand.

There are potentially problems with groundwater at shallow depth, and with the risk of the wooden piles in waterlogged ground which support many of the older buildings. Tunnel driving is expected to be completed in 2016, with track, signalling and stations to be installed in the following two years.

SOURCE: SMALE, Katherine, 2016, Keeping everyone in the loop. *New Civil Engineer,* 17 December 2015, 62–63.

Citybanan test trains now running below Stockholm. Sweden

Members who attended our Swedish study visit a few years ago based at Nykoping and Stockholm will remember the Citybanan open day when the new rail tunnel under the city, then in course of construction, was open to anyone and everyone, with guided tours led by real engineers. And there were free cinnamon-flavoured buns and tea and coffee, and balloons for the children, and free leaflets explaining the whole project. No such events have been organised in connection with London's Crossrail, of course!

The tunnelling was completed in September 2014, and test trains have been running since 14 January 2016. The new 6-km tunnel provides a new through cross-city route via low-level platforms at the city's Central Station, by-passing a double-track surface bottleneck. Most of the excavation was by drilling and blasting through hard rock, but the section under water between the Central and Södra (South) stations is in a submerged concrete tube. The work is ahead of schedule, including two new subsurface stations, with public service trains scheduled to be running by July 2017.

SOURCE: *Modern Railways* 73(810), page 85.

More tunnels under Naples rediscovered

A labyrinthine network of 400-year-old tunnels, caverns and cisterns has been rediscovered under the streets of Naples after a tip-off from a man who sheltered in them during World War II.

Experts have uncovered a vast room and three levels of passageways covering 1000sq m – filled with rubble, sealed off and forgotten after the war – dug into the soft volcanic rock under the city's Monte di Dio neighbourhood. 700 tonnes of rubble were excavated to uncover a hidden world, centred on a perfectly preserved seventeenth-century cistern that stored water for a grand palazzo 30 metres above in the Monte di Dio neighbourhood.

They also found twentieth-century lavatories added during the war, when fascist officials turned the space into a bomb shelter as British and US aircraft pounded the city with 200 air raids, killing up to 25,000 people. The team found a long access staircase with 115 steps, dug in the war, that ended under the floor of what is now an art gallery. A hole was punched through the floor and this is now used as an entrance for visitors.

Over the centuries, Neapolitans excavated stone to create cisterns and used it to build large residences directly above. The cisterns were fed with spring water from underground aqueducts and accessed from well heads in the house courtyard. Linked by maintenance tunnels, this underground world also offered clandestine access to rich homes for thieves or secret lovers, who climbed up the well shafts.

There are thousands of these cisterns in Naples, but many

were filled with earth when plumbing arrived or with bomb rubble after the war.

See 'Underground Naples' in *Subterranea* 31 (December 2012), page 41.

SOURCE: *The Times,* 11 March 2016.

Business is booming at the Victoria Tunnel in Newcastle-upon-Tyne

The tours began when the Ouseburn Trust took over management of the Victoria Tunnel six years ago, with guides recently marking the structure's 174th anniversary. Now the tunnel tours are rated number one in things to do when visiting Newcastle with around fifty guided tours a month. Such has been the success that the Trust is appealing for more guides to boost the current 34 volunteers.

Tours for up to 15 people last for around two hours, taking in a distance of three-quarters of a mile from the tunnel entrance in Ouse Street. Visitors can see what remains of its wartime usage as an air-raid shelter, including a crucifix from the time fashioned from concrete into which is engraved a list of names.

As well as the public tours the tunnel has also hosted an orchestral performance, a play, and an art exhibition.

Preparations for the tunnel to be used as an air-raid shelter, 1939

The 2.4 mile Victoria Tunnel was built between 1839–42 to transport coal from Leazes Main Colliery in Spital Tongues to riverside staithes (jetties) where the Tyne meets the Ouseburn, ready for loading onto boats for export. Loaded wagons descended the incline of the tunnel under their own weight, and were rope-hauled back to the colliery by a stationary engine. The Colliery closed in January 1860 and the Tunnel was abandoned until the start of the Second World War when it was converted for use as an air-raid shelter.

The Victoria Tunnel was visited by members of Subterranea Britannica during the Newcastle study weekend in October 2014.

SOURCE: *Newcastle Chronicle,* 2 March 2016.

Hallandsås rail tunnel opened, Sweden

Sweden's longest railway tunnel, constructed on the west coast main line from Malmo to Gothenburg between 1992 and 2015, opened to traffic in December. There was a delay in construction for eight years from 1997 as a result of groundwater problems and contaminated water discharges. Tunnelling through the wet ground was achieved by freezing the rock and soil being bored through, and installing a watertight lining.

The 8.7-kilometre new twin-bore tunnel has 19 cross passages linking the parallel bores, and by-passes a steeply graded single-line surface section, allowing increased capacity and a doubling of passenger train frequency. New station buildings have been erected on the realigned track.

SOURCE: ANON, 2016, Sweden: Hallandsås tunnel opens. *Modern Railways* 73(809), page 84.

Proposed tunnel to link Helsinki (Finland) and Tallinn (Estonia)

The capitals of Estonia and Finland are separated by the Gulf of Finland. To travel by land from one to the other is a journey of 500 miles via Russia. There is a ferry link, allowing a two-hour journey (apparently doubling up as a 'booze cruise!). However, a 50-mile rail tunnel link is now proposed, with the capital to capital journey time to be reduced to half an hour.

SOURCE: TOPHAM, Gwyn, 2016, Finland-Estonia tunnel a step closer to reality. *The Guardian*, 7 January 2016, page 16.

New rail tunnels to link Dresden (Germany) with Prague (Czech Republic)

A new main rail line for fast trains between Dresden in Saxony and the Czech capital via the industrial city Usti-nad-Labem will include a 26.5-km tunnel under the Erzegebirge (ore mountains) and another of 17 km near Litomerice under the Krusne Hory mountains. At present trains between the two major cities are routed alongside the river Elbe, a scenically very attractive route, and the Czech town of Decin.

SOURCE: ANON, 2016, Planning under way for new cross-border high speed line. *Modern Railways* 73(810), page 82.

Biscuit tunnel opens in Reading

The opening of the new underpass in Reading means people living in Napier Road and Luscinia View now have direct access to and from the town centre and east Reading. For people heading north from the Kenavon Drive and Newtown areas, the new link provides much improved access to the River Thames and Caversham.

The tunnel was originally part of the railway and was used to link Huntley & Palmers biscuit factory to a mainline railway siding. Two little 'biscuit trains' would shuttle back and forth carrying *Hobnobs* and *Ginger Nuts* to be loaded onto trains and off to all corners of the British Empire. The underpass has been unused since biscuit production ceased in Reading in 1976.

SOURCE: *Get Reading*, 25 November 2015.

Museum curator convicted of fraud and theft from the Broadway ROC Post Museum

The 65-foot-high Broadway Tower is a folly on Broadway Hill, near the village of Broadway, in Worcestershire and, at 1,024 feet above sea level, is the second highest point of the Cotswolds.

The mock-Saxon tower was the brainchild of Capability Brown and designed by renowned architect James Wyatt in 1794 in the form of a castle, and built for Lady Coventry in 1798–99. The tower was built on a beacon hill, where beacons were lit on special occasions. Lady Coventry wondered whether a beacon on this hill could be seen from her house in Worcester – about 22 miles away – and sponsored the construction of the folly to find out. Indeed, the beacon could be seen clearly.

Throughout World War II the tower was used by the Observer Corps (Royal Observer Corps after April 1941). The ROC was stood down on 12 May 1945 but was reactivated in September 1947 as the Cold War was developing. An Orlit aircraft observation post was built close to the tower in the 1950s and in June 1960 an underground nuclear monitoring post was opened 50 feet from the tower. The post remained operational until September 1991. It was very fitting to locate the post next to the earlier beacon as the ROC badge shows a man holding a torch as a beacon to warn of enemy attack.

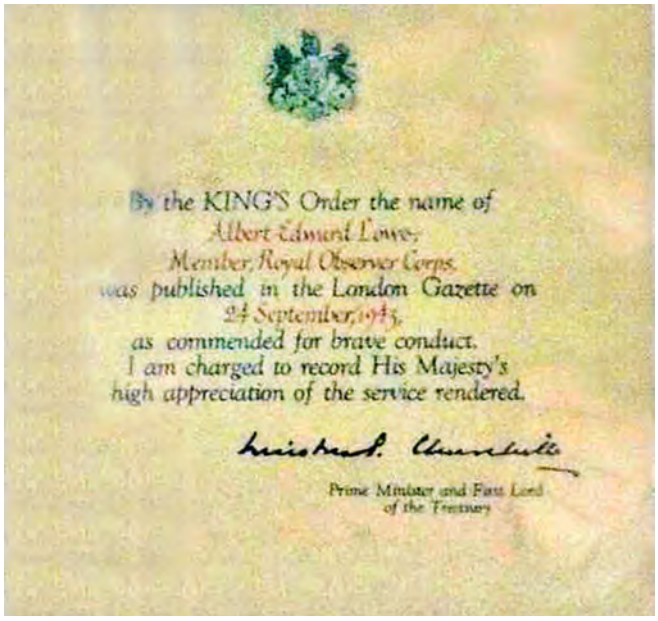
Today, the tower is a tourist attraction and the centre of the Broadway Tower country park with various exhibitions open to the public, as well as a gift shop and restaurant.

In February 2009, Neil Thorneywork, a former Bromsgrove councillor, was employed as General Manager of the Broadway Tower Museum. The Country Park staff were blissfully unaware that, in 1999, Thorneywork had been banned from trading as a broker after complaints that he had sold stocks without the permission of clients.

Thorneywork quickly saw the potential of the bunker as a visitor attraction and contacted Sub Brit for advice in March 2009. It was first opened in June 2010 and a large number of people came along to see what was, at that time, just an empty shell. After the success of the initial visit, Thorneywork began a process of re-equipping and restoring the bunker which was officially opened by mid-Worcestershire MP Peter Luff on 20 May 2011.

After five years in the post Neil Thorneywork was sacked in January 2015. He appeared at Worcester Crown Court in February 2016 when he pleaded guilty to one charge of theft and one of fraud.

The court heard one of his tasks as museum curator had been to take copies of a Certificate of Commendation signed by Winston Churchill and presented to Albert Lowe of the Royal Observer Corps for his brave efforts to save three airmen after their Whitley bomber crashed close to Broadway Tower on 2 June 1943. Sadly, Sgt Ekins and fellow crew members all perished. It was one of only three such certificates given out to Corps members and Mr Lowe's family donated it to the museum in 2011. It has since disappeared and Thorneywork told the court he did not know where it was. He stated that he had stolen the sentimental document because he was struggling to pay his mortgage.


By the KING'S Order the name of
Albert Edward Lowe,
Member, Royal Observer Corps,
was published in the London Gazette on
24 September, 1943,
as commended for brave conduct.
I am charged to record His Majesty's
high appreciation of the service rendered.
Prime Minister and First Lord
of the Treasury

The theft charge related to a bomb power indicator. One of these instruments was missing from the museum and, after he was sacked, Thorneywork offered to sell one to the museum which he claimed was his property and produced a receipt as proof. The museum agreed to buy it from him for £1,250 as it was an integral part of their display. The receipt was however bogus as the item had already been donated free from another museum before he claimed to have bought it.

The judge said the loss of the Churchill certificate appeared to be the most serious offence because although it was valued at £500, its sentimental value to the family was much higher. He gave Thorneywork a 12 month sentence suspended for two years on each count, to run concurrently. He was also ordered to do 200 hours unpaid work within twelve months. He was ordered to pay £1750 compensation to Broadway Tower Country Park Ltd.

It is tragic that the work of volunteers and enthusiasts working to preserve our heritage has been impacted by such criminal activity. It is possible that other artefacts donated to the museum may also find their way onto online auction sites – an environment where sellers can sometimes hide behind a false identity. Buyers should always check the provenance of all items purchased.

SOURCES: *Birmingham Mail* 14 February 2016; *Daily Mirror* 11 February 2016; *Evesham Journal* 10 February 2016; *Cotswold Journal* 26 May 2011; and Wikipedia.

Sub Brit visit to Cold War sites in Oxford

Adrian Armishaw

Dave Johnson of the Oxfordshire County Council Emergency Planning unit in the former Communications Room where some of their historic material relating to the site during WWII and the Cold war is displayed. Photo Adrian Armishaw

On 5 March 2016 twenty Sub Brit members braved varying degrees of snowfall to visit two Cold War sites in Oxford.

The first was the former Oxford ROC number 3 Group Control Headquarters which functioned between 1965 and 1992. In 1998 the surface entrance level of the bunker was demolished and blocks of student accommodation built around it for Oxford Brookes University. The two lower levels have been retained and are currently used for the storage of bedding and other stores for the adjacent student housing.

Emergency Entrance

The bunker is approached via a long open ramp which leads to an ordinary looking door. We walked through into a lobby area which is not recognisable as being part of the plan of a standard Royal Observer Corps HQ layout. We were set free to roam at will and it gradually became clear that we had entered through what would have been the emergency exit and had been standing at the end of the spine corridor on the main floor. This was not obvious at first as the partitions creating the first rooms on the right had been removed to create a larger storage area.

Beyond the stairs which lead down to the control room floor the rooms have been retained and the corridor is its usual width. Those of us who had visited several similar structures previously were surprised how disorienting it was to enter from an unusual point.

The top level entrance to the Oxford ROC Group Control, often referred to as an 'Aztec Temple', shortly before redevelopment of the site in 1998.
Photo from Oxford Brookes University

The first door on the left led to the control room balcony. The post display boards remain in place around the edge of the balcony but have been fixed in position to prevent them from turning (we did try). Only a few retain the

The control room seen from the lower floor. The post display boards are seen on the balcony. Photo Adrian Armishaw

post designators, the rest have been over-painted. A red lamp survives on the side of the balcony though no one present was sure of its function.

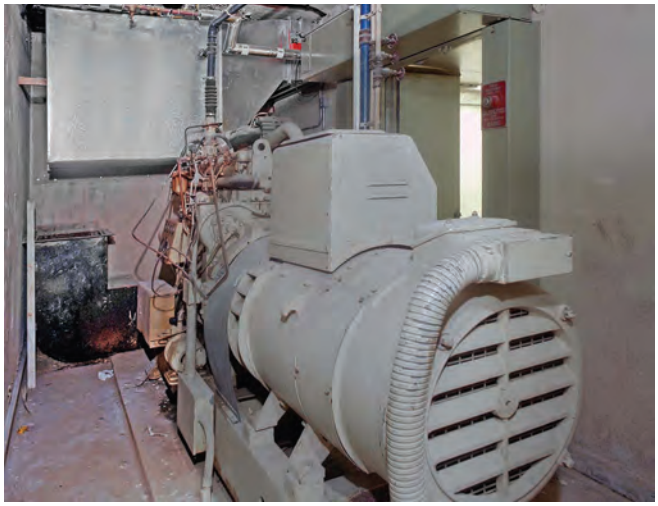
In the alcove off the balcony where triangulation took place the post instruments would have lived and even though they have disappeared, the flange of the FSM (fixed Survey Meter) pipe can still be seen in the ceiling. The rear wall of the alcove has been knocked through into the room beyond which once housed the telephone exchange, and the far wall of this has also been knocked through into the canteen.

A breath of fresh air

Through a hatch can be seen the kitchen which remains in its original position with extractor hood and sinks. The next room at the end of the corridor is the plant room. Most of the ventilation equipment has been replaced or renovated and it was quite unexpected to enter a warm plant room to find the smell of hot oil and the fans running.

Beyond this is the generator room which remains largely unaltered, although the generator itself is not in operational condition. Where steps would once have led up to the entrance level, a pair of fire doors now led through the wall to the outside. The outline of the original toilet fittings can be seen and the officers' room has been converted into a working single sex/ disabled toilet.

Downstairs, the lower level is piled high with quilts, pillows, towels and similar but as the well hasn't been floored over the whole still retains the feel of the original layout. We are fortunate that Oxford Brookes has retained much of the historic structure and the fact that the building remains in use has kept it heated and dehumidified. As often happens on Sub Brit trips, those who had more knowledge were happy to explain how the HQ would have operated to the several newer members who it was good to meet.



The emergency generator. This would only have been used if the mains supply had been cut off. Photo Nick Catford

Woodeaton Manor

We returned to our cars and arrived at Woodeaton Manor after a short drive. The house is a Grade II listed building which was built in 1775 and since 1950 has been a school for children with special educational needs. At the moment it is undergoing a major renovation but a gap in the scaffolding led to a grassed area beside the house. This conceals the Oxfordshire County Emergency Centre which was purpose built in 1960.

The emergency exit stairs at the back of the bunker. This would have been used as the main entrance in the event of a nuclear attack. Photo Chris Rayner

Following a welcome and brief introduction in the car park (snow flurries had given way to bright sunshine); we were led down a flight of steps beside the house past the filter room and through an air lock into the bunker. The innermost door of the air lock can only be opened from inside or with a code. This became apparent when I went outside to photograph the entrance and the door closed behind me!

Finding ourselves in the main corridor, we turned left into the cellar of the original house which in the Cold War era would have housed support groups such as Police, Fire, Military and Food. It still houses the two emergency generators for the bunker but was sadly off-limits as it comes under the school's jurisdiction.

Turning right leads past toilets and a kitchen to emerge

in what was the scientific advisor's room. The current emergency team had carefully preserved lots of the documentation and artefacts they inherited from the Civil Defence. This was spread out across the tables and we were invited to spend as much time as we wanted reading through it, which was fascinating. As well as the usual Civil Defence leaflets there was a comprehensive history of the bunker from first conception and numerous fallout predictor circular slide-rules.

The largest room in the bunker was the Main Control Room – in this view one is standing with one's back to the emergency escape airlock and looking towards a small Store Room now used as an office. A door leading to the Communications Room is at the far end on the left side. Photo Chris Rayner

Ground Zero

A large map on the wall had been marked up to show the predicted path of fallout from a possible nuclear strike on Oxford. There was also a board detailing all of the peacetime emergencies which Civil Defence attended between 1950 and 1962. Some are memorable, others more obscure as with "1962, West Bromwich, Lorry Explodes". Laminated photographs of what the bunker looked like in Civil Defence days were posted around the bunker – these were very helpful.

At the far end of this room a door leads through to a further large office. We were not allowed to enter as it is the current working office of the Oxfordshire Emergency Planning Unit. A door to the left leads to the main control room, which has the luxury of two emergency exits.

The original exit was accessed via a low hatch in the wall which led to a sand-filled shaft (now plugged). In the 1980s emergency stairs were added complete with an air lock and with pairs of Andair pressure-relief vents. As we headed back towards the entrance we could see further smaller offices, work rooms and a communications room with connections on the wall leading to various aerials which were mounted on the roof of the house.

The kitchen was very basic and would only be used for preparing light refreshments. Clearly nobody was expecting a long stay. Photo Chris Rayner

Grateful Thanks

Although very much in day-to-day use, the bunker retains lots of its original features such as message hatches, suspended ceiling and storage cabinets and even kitchen fittings. When I said my good byes and left I noticed that many members were still engrossed in the bunker paperwork! Thanking our hosts, I headed back up into the sunshine – seeing two bunkers in such an excellent state of preservation is different to my usual haunts!

Thanks are due to Oxford Brookes University (Juliette Ashton and Angelina Mihaylova) and to Oxfordshire County Council Emergency Planning Unit (Carol MacKay and Dave Johnson) for allowing the visits and making us all so welcome. And of course to Chris Rayner for organising the visits and for his clear joining instructions.

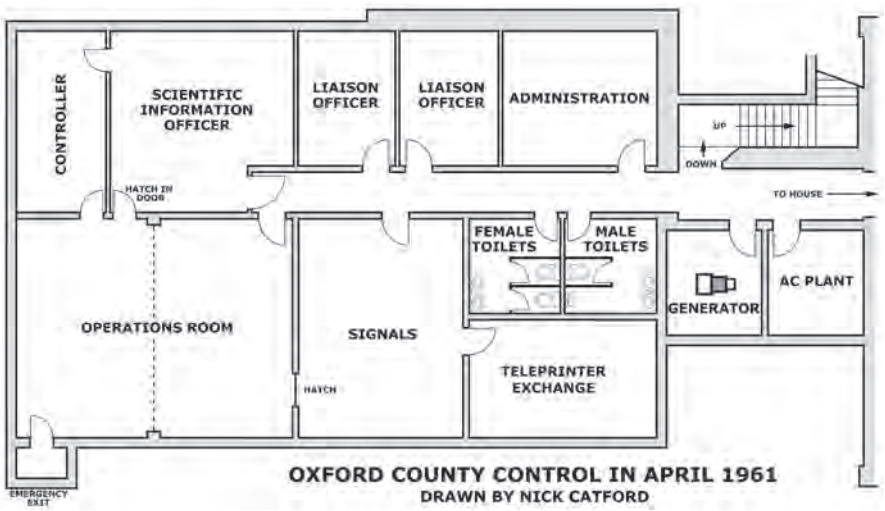
Our hosts were without exception welcoming and enthusiastic and we hope that future visits will be possible for Sub Brit groups.

Further Information

Further information about these sites can be found on the Sub Brit website:

www.subbrit.org.uk/rsg/sites/o/oxford

www.subbrit.org.uk/rsg/sites/o/oxford_emergency_ecntre/index.html



Wartime Treasure Vaults

Chris Rayner

Air-conditioning plant in superb condition at Westwood Quarry. Photo Nick McCamley

Once the Zeppelin bombing raids on London began in the latter part of the World War I, there were concerted efforts to safeguard the nation's treasures in city museums and art collections by finding temporary safe lodgings for them.

While larger objects in the British Museum were sandbagged in situ, their most priceless documents were sent away to the National Library of Wales at Aberystwyth for safekeeping; the remainder being squirrelled away in basements around Bloomsbury or in the Post Office railway tunnels at Holborn. Other sections of the Post Office railway were also used by both the Tate and National Portrait Galleries to store their finest paintings, while the National Gallery and the Victoria and Albert Museum took advantage of disused sections of the London Underground at Aldwych and South Kensington respectively to store their most precious items.

World War II

Two decades later, the likelihood of another war with Germany brought the same institutions together to look for common solutions and put pressure on the government for financial support. There was some limited funding available for strengthening the basement ceilings of museums and galleries in London, but for most institutions the impetus was to find large country houses well away from potential bombing targets.

Stately-home owners were very willing to provide space rent-free, seeing it as way of avoiding having evacuees or military units forced on them, but many

Bringing a section of cornice from the Xanthos Nereid Monument into Aldwych station, with men using simple rope pulleys and a primitive brake to lower it down improvised slide on top of pedestrian stairs. Both this and the sacking protection to the stone surface would give conservators nightmares today. Photo Nick McCamley collection

of the buildings turned out to be unsuitable. They were cold and damp, almost impossible to heat economically, prone to woodworm, and with significant fire risks. Their (sometimes eccentric) owners could also be a force to be reckoned with, particularly when they were pressed by the billeted museum or gallery custodians to increase heating levels at their own expense. It was shortcomings such as these, as much as the ever-growing reach of enemy bombers, that led to a new drive for safe underground repositories.

Unused sections of the London tube were once again in demand. Tunnels at Aldwych were earmarked for the British Museum and Public Records Office but the difficult access, the damp, humid atmosphere and the relentless seepage of water made them unsuitable for most items. The Elgin Marbles were among the few treasures that were stored here.

The Victoria and Albert Museum intended to use neighbouring Brompton Road's disused station tunnels, but even though they had written agreements with London Transport to that effect, they were gazumped by the War Office's purchase of the site's freehold in order to use it as the capital's anti-aircraft gun control room.

Aberystwyth

Underground sites outside London were more highly prized, and some had been preparing for the eventuality of war for many years. The National Library of Wales in Aberystwyth already had some experience of this, having been used by the British Museum as an above-ground refuge for books and documents towards the end of World War I. The experience had led the Library to consider more secure alternatives, which coalesced into a plan to excavate a 30-metre-long air-conditioned tunnel in the side of Grogythan, the Hangman's Hill, a few hundred metres away from the library.

Excavation in progress at Aberystwyth, showing the dipping slate beds that would cause structural problems. A sign warns "Danger - Entry into this Tunnel strictly forbidden". Photo Nick McCamley collection

This was very far-sighted as many considered Aberystwyth to be beyond the reach of enemy bombers both physically and morally, with the Library's prominent position, acting as a navigational landmark, ensuring its safety in the final analysis because, after all, who would want to bomb a library?

Plans for a horseshoe-shaped tunnel were drawn up by Charles Holden, designer of many of London's Underground stations, but the projected cost was too much for the Treasury, concerned about the likelihood of future cost increases and demands for similar levels of protection from other galleries and museums, and not least the public. Undeterred, Aberystwyth went ahead and started to build their tunnel, albeit a shorter one, in August 1938, a bold move in those uncertain days before the fall of France.

The Grogythan storage tunnels at Aberystwyth in use during the war. A slim wide duct is fixed up against the horizontal section of the ceiling with outlets, possibly for extract, at regular intervals. Timber slatted shelves and supports allow ventilation around the storage boxes and their priceless contents. Photo Nick McCamley collection

National treasures go underground

The tunnels took fourteen months to build and part way through the process Treasury funding became available when the British Museum purchased for £3,000 a half-share of the tunnel. It was later used to store ninety tons of documents from the British Museum's library, the "cream of the collections" which included drawings by Leonardo da Vinci, one of the handful of copies of the Magna Carta, Nelson's Trafalgar Memorandum sent just over a week before the fateful battle and which detailed

his tactics for engaging the French and Spanish fleets, and Scott's Antarctic journals.

The tunnels are approached via an adit leading to a short blast-offset cross-tunnel and thence via steel blast doors at either end to a chain of four angled rectangular chambers which, together with the cross-tunnel base, form a crude pentagonal shape. The entrance adit and blast offset however are largely unlined rough slate, while the chamber walls are brick-lined and plastered, and are roofed over with a false ceiling of – now mouldy – boarding in three sections concealing a brick vaulted roof. It appears that the need to line the tunnels and thus reduce their effective size was necessitated by structural problems encountered in early 1939 which increased the overall costs to £7,000.

Looking along the Aberystwyth blast offset tunnel to one of the repository entrance doors, with the main entrance tunnel on the left. Brick and concrete were used to reinforce the slate bedrock at weak points. Photo Chris Rayner

Former ductwork openings at Aberystwyth above the vault entrance steel door, with a mirror image entrance at the far end of the blast offset tunnel beyond. Photo Chris Rayner

Interesting features include the internal cast-iron gutters at the ceiling edges which may have been retrofitted to deal with condensation, vertical wall slots whose function is unclear, and gates subdividing the shelter into two parts (of two chambers each) which must have followed the British Museum's half-share purchase.

The shelter was very advanced in its use of air conditioning to maintain optimal temperature and humidity conditions, and has been described as "Britain's first experiment in air-conditioned underground storage". The system was installed over several months in which tests of environmental conditions were carried out with a variety of electric heaters and fans to assess the best combination of temperature and humidity.

Staff sleep on the job

The technology was in its infancy though, and museum staff were so concerned about it breaking down that they took it in turns to sleep in the tunnel. To reassure them, and as part of an emergency back-up, a hand-operated pump was also installed. Sadly little survives of this today.

The vaulted ceilings at Aberystwyth were backed up with cast iron rainwater pipes, possibly during postwar usage following removal of the air conditioning.
Photo Chris Rayner

Back on top of the hill, the stored collections within the National Library itself began to feel less secure following the capitulation of France in June 1940 and new, safer locations began to be looked at in earnest. The Victoria and Albert Museum offered to share the use of Westwood quarry near Bradford-on-Avon which was subsequently used to house overflow British Museum material from the Library, while the National Gallery moved its Aberystwyth material north to Manod quarry, near Blaenau Ffestiniog in Snowdonia.

The Main Passage at Westwood Quarry in use as a wartime repository with V&A Museum storage on the left on stepped platforms and British Museum crates on the right.
Photo Nick McCamley collection

Westwood Quarry

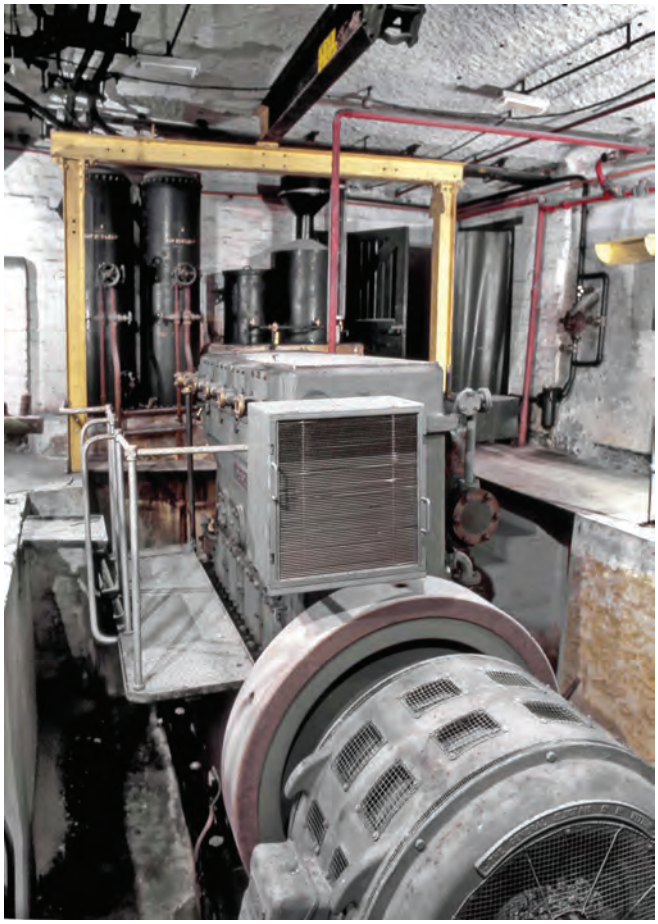
The Bath stone quarries of Wiltshire had mostly been commandeered for military munitions storage, while away from the Corsham area, Westwood Quarry near Bradford-on-Avon had been allocated to the Royal Enfield Motorcycle Company as a "shadow" factory for the production of bomb sights. Not all the floorspace was needed however and 2100m^2 was made available to the British Museum, the Victoria and Albert Museum and the Public Record Office.

Centralised electrical switchgear at Westwood Quarry showing delineation between the Museum repositories and the Royal Enfield shadow factory. Photo Nick McCamley

The British Museum had already looked at a salt mine in Cheshire, but apart from humidity and storage problems, the difficulty of access here via a 120m vertical shaft was always going to be a limiting factor. Westwood did not have problems on the same scale but still needed considerable structural alteration. The sloping quarry floor, for example, had to be terraced to allow the Victoria and Albert Museum's furniture collection to be stored. There needed to be large open spaces where Oriental carpets could be periodically unrolled and checked for insect damage or signs of mildew. The quarry entrance also needed to be enlarged to allow large crates to be brought in, after which the British Museum's vault doors were hung on it for security.

Air conditioning was essential to maintain a constant temperature of 18^{o}C and sixty percent relative humidity, and a large plant room was built to accommodate it. The quarry rock surface had been treated with a damp-proofing render, but even with this, just a few minutes pause in the running of the ventilation plant would let the humidity level creep back to 95 percent.

In the end, it took three months of the plant running at full power to dry out the structure to the desired level. Everything then seemed to be running well, until suddenly in April 1942, the humidity levels jumped back to the pre-drying-out levels. Staff were mystified – the plant seemed to be running well, and none of the warning alarms had been triggered.



The new postwar diesel generator at Westwood provided at the joint expense of the Museums & Galleries ARP Committee and Royal Enfield (British Museum artefacts were retained at Westwood until the mid-1950s until Blitz damage repairs at the museum were completed, while Royal Enfield continued production underground until 1968). This replaced a searchlight generator mounted on the surface, which in turn was a temporary wartime expedient replacing the original ancient and very defective generator installed in 1942. Photo Nick McCamley

It was found that the problem was caused by the normal seasonal increase in humidity coupled with poor stacking of stored material which had cut off cross-ventilation paths. Restacking was very quickly carried out and standby generators were brought in which solved the problem; however generators proved to be an ongoing problem, the intended permanent replacement suffering repeated breakdowns and eventually exploding.

Manod Quarry

The National Gallery's search for a wartime home for its paintings had started in 1934. At the start of the war they dispersed their greatest treasures between a number of above-ground sites, including a couple of Welsh castles and a Cotswold country house tantalisingly named Old Quarries. As the range of German bombers increased, they even considered sending valuables abroad before committing to find their own underground stronghold.

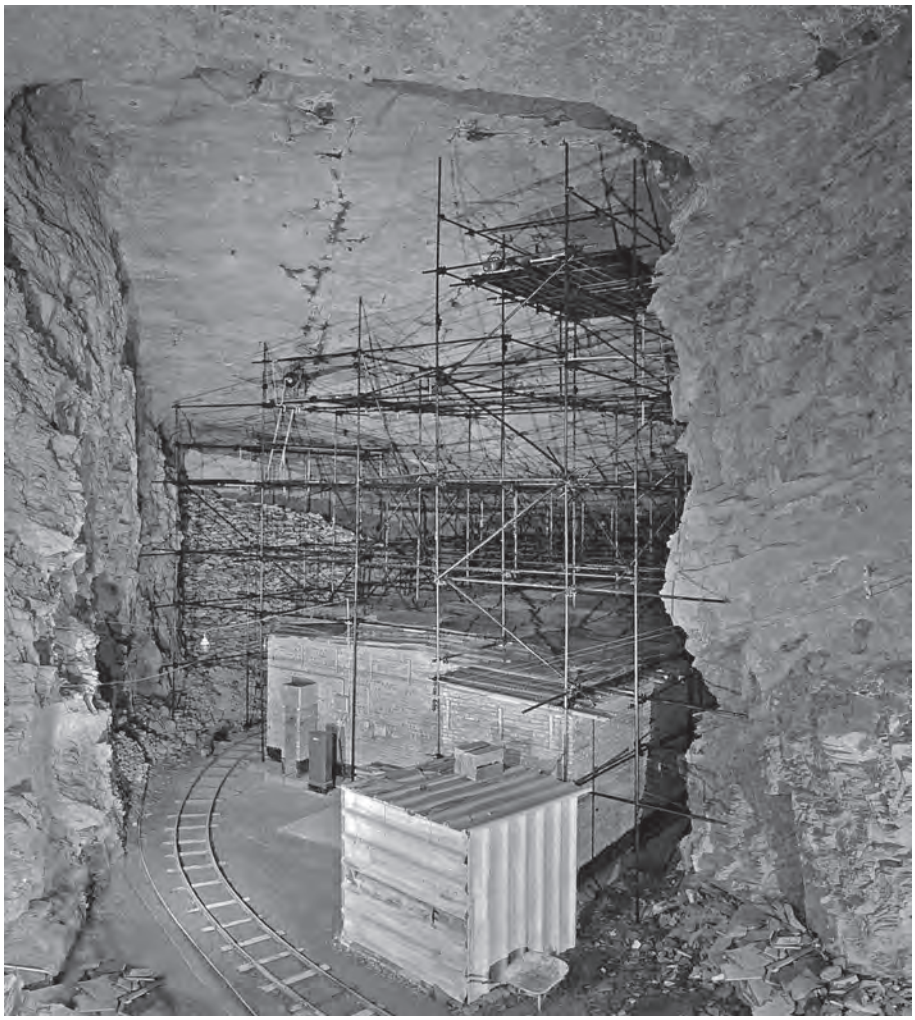
The only suitable one they found was at Manod Quarry near Ffestiniog in North Wales, an exceptionally remote location at the end of an eight-km-long private road in

A Great Western Railway lorry laden with paintings from the National Gallery approaches the Manod quarry entrance after the long drive up into the mountains. Photo Nick McCamley collection

the Cambrian mountains. The quarry had very large underground chambers within which the Gallery built six environmentally-controlled storage buildings, nicknamed bungalows. These were located in sections of the quarry considered safer from roof falls, and had bitumen-tanked floor slabs, cavity brick walls and mineral felt roofs. Five of them were built with a clear headroom of three metres while the sixth was four and a half metres in order to take the tallest canvases.

The National Gallery stored their paintings in purpose-built brick chambers within Manod Quarry. In the foreground one of the wagons for painting transport is stopped outside a profiled steel sheeted enclosure probably used as a plant room for drying the silica gel trays used to reduce humidity within the chambers. Photo Nick McCamley collection

Each building had its own air treatment plant to ensure a strict level of 18°C temperature and 57 percent relative humidity. Road access had to be considered too and to fit one of the largest paintings (the great Van Dyck *Equestrian Portrait of Charles I*) under a low railway bridge near Blaenau Ffestiniog, the road had to be lowered in order to increase clearance.

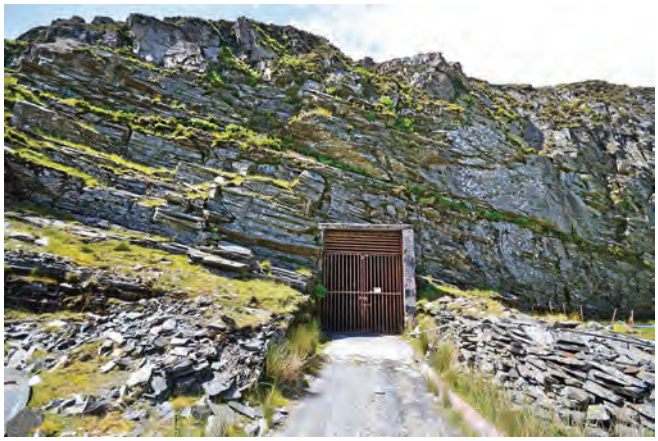


Temporary scaffolding erected above the painting storage chambers at Manod to allow the rock ceiling to be checked. Photo Nick McCamley collection

Smaller Repositories

London's museums and art galleries were not the only bodies taking measures to protect their most prized possessions. Many regional museums also took precautions, and there were also a number of other groups with more prosaic treasures. Banks, local authorities and other organizations were in many cases more concerned about the loss of vital documents in bombing than the lives of their staff, and many moved their records to safer outlying areas, some even going so far as to build underground repositories.

The Woolwich Building Society, for example, acquired a site near Sevenoaks in Kent in 1939 to serve as emergency offices and accommodation for its staff. To protect their records though they dug down thirty metres into the chalk and built a small grid of tunnels connected to the surface by three vertical shafts (two for access and one for ventilation). When reopened briefly in 2010 by the Kent Underground Research Group following research by Sub Brit member Steve Quinton, the main access shaft was found to have metal



The approach to the Manod Quarry entrance today has been narrowed by piles of quarry deads. Photo Chris Rayner

Storage chambers at Manod. The short surviving section of narrow-gauge tramway seen here is the same tramway seen in the bottom left photo on page 34.
Photo Ted Burgess

ladders that were still in good condition. From their base, a concrete-lined passage ran for a short distance, before regressing to a timber-lined one.

The tunnels, referred to in contemporary documents as a "storage room", were laid out in a tight grid of low-ceilinged passages, almost square in section with thin walls of peeling render on timber boards. Originally there would have been independent full-height racking

Timber lined entrance passage at Sevenoaks opening into a grid of plaster lined repository passages. Photo Chris Rayner

Frozen rain of stalactites formed by salts leaching out of the gypsum lime plastered ceiling in the Sevenoaks repository. Photo Chris Rayner

for documents so the timber wall was intended just to keep back some of the damp and moisture.

The original ventilation plant had included silica gel to help reduce the air humidity; however, seventy years on, the air felt almost completely saturated and the timber props of the entrance passage had the appearance and strength of chocolate flakes. It seems to have had several years of use at least, though, with one pencil signature recording the date "24/5/43".

Chalk roof partial collapse making access awkward in the Sevenoaks repository entrance tunnel. Photo Chris Rayner

Another, now sealed, document store was built in a former quarry at Adel near Leeds for the Leeds Permanent Building Society, and is marked on the surface by a pair of

In situ concrete entrance to the Leeds Permanent Building Society's two-level Adel repository. Photo Chris Rayner

concrete cubes leading down to 700m^3 of storage space on two levels. The bunker was apparently waterproofed with brick walls and asphalt tanking. One of the access points had a dumb-waiter lift to allow documents to be lowered down and brought back up quickly. Condensation, though, was a problem and caused rusting of deed boxes. Leeds Corporation also used the store to keep safe important documents, including its 17th-century Charter.

Mines and Quarries

Redundant mines and quarries were often used. Brighton Council stored documents in a disused chalk pit near Poynings in the South Downs, excavating and building a small brick-lined room. It seems poorly built though, given its purpose, as evidenced by its strange timber roof resting on steelwork with an inner ceiling lining of corrugated steel.

Local authorities were particularly in need of suitable sites. Bristol City Council reused a redundant railway tunnel below the Clifton Suspension Bridge for its archive storage in 1940. They built two floors of stores on one side of the tunnel with a tall vaulted corridor on the other.

The storage rooms are named on their doors:

Lower level storage room in the Bristol City Council records store with an open grilled ceiling above to assist ventilation, while a very narrow ventilation ducts appears to run along the top of the steel racking. Ventilation was sacrificed for security in the choice of a door though. Photo Chris Warren

"City Engineer", "City Valuer (Top Floor) – City Treasurer (Ground Floor)", "Docks Department", "Rating Department", "City Architect (Top Floor) – Medical Officer (Ground Floor)", "Police" and the enigmatically named "Archives". One almost imagines a City Hall in miniature.

The space is now flooded and abandoned metal boxes titled "Housing Committee" and "Title Deeds and C. of the Estates in Somersetshire" are rusting away. Within the store rooms, the open-grilled steel floor of the upper level is accessible via a ladder.

In some cases a local authority would use a small portion of a public air-raid shelter to store its records. Southwark stored its council archives in a specially built strong room within the very large Southwark public shelter that had been formed within the King William Street to Borough underground line that had closed well before World War I.

Underground factory in Kent

The Shorts seaplane works in Rochester also had some very early air-raid shelters which included, at their northern end, three vaulted chambers with wrought-iron gates. Two were retained for Shorts' own use as an emergency wages office and a jig and tool office library, an essential requirement for a factory involved in top-secret military aviation research and development.

Gated entrance of the vaults at the Shorts Seaplane factory in Rochester. Photo Chris Rayner

The third, furthest from the factory's underground works, was kept for local authority emergency use and is marked "City Surveyor's Office" on a shelter plan. It is not known what might have been stored here, but one can imagine it may have included copies of building and services plans vital in the case of emergency repairs and reconstruction.

Many of Churchill's wartime speeches have become well known across the country, even generations on. From a Sub Brit perspective, no quote is perhaps more pertinent than Churchill's response to Kenneth Clark, the Director of the National Gallery, when the latter suggested shipping paintings to Canada for safe-keeping. "Bury them in caves and cellars," he said, "None must go. We are going to beat them."

The Origin of the RSGs

Steve Fox

The original kitchen area inside RSG9 at Drakelow. Photo Nick Catford

During the Cold War the government secretly established a series of headquarters around the country from which Regional Commissioners would attempt to govern a Britain shattered by nuclear war. These headquarters, which were known as RSGs, or to give them their full designation **Regional Seats of Government**, first came to public attention in 1963 with the distribution of the pamphlet titled *Danger! Official Secret – RSG6* by an anarchist group calling themselves *Spies for Peace* who had stumbled on the RSG at Warren Row near

Warren Row was just minutes from the route of the march. A large number of people left the march for a few hours to occupy the site. Photo Les Pearce

Reading apparently by accident. The site was later occupied by 'ban the bomb' marchers returning from Aldermaston which gave further publicity to the RSGs.

Evolution

The pamphlet gave the towns and cities where the RSGs were but not their actual locations. However, these clues allowed other like-minded groups to find the RSGs at Edinburgh, Cambridge and possibly others. But the RSGs then disappeared from the public eye until the publication in 1982 of Duncan Campbell's seminal work on British civil and home defence *War Plan UK* which followed up on the *Spies'* information from twenty years earlier and gave more detail of the locations and role of the RSGs, although by that time they had ceased to be part of the civil defence "order of battle".

It would be another twenty years before official records relating to the RSGs became publicly available at the Public Record Office (now the National Archives) at Kew. There are unfortunately some gaps in the records but there is enough information available to trace the origin both of the functions of the RSGs and, perhaps of more interest, their sites. And it shows that rather than suddenly appearing in the early 1960s the RSGs were the result of an evolution. And an evolution which was far from straightforward.

The origins of the RSGs can be traced back to the World War II and the air attacks on Britain. Before the outbreak of war a substantial organisation had been set up under the auspices of the Home Office under the general name of ARP or Air Raid Precautions. The bulk of the ARP work was done at local level with local councils organising most of the effort. At the same time, the country (excluding Northern Ireland) was divided into

The entrance to RSG6 at Warren Row in the 1990s, now a commercial store

twelve regions each under the control of an appointed Regional Commissioner. The public role of the Regional Commissioner was to coordinate the civil defence work of the local authorities but at the same time he (they were all men) had a secret role.

The Commissioners were empowered under the wartime emergency regulations to take over the full powers and functions of central government should the Commissioner lose contact with the central government in London which might have come about as the result of severe air attack or invasion. To assist them the Commissioners were each provided with a protected headquarters although these were usually just in the strengthened basements of the large house that had been taken over to provide working accommodation for the Commissioner and his team. None of the Commissioners was ever called upon to assume supreme power but their efforts in organising basic civil defence were effective.

Demobilisation and Reactivation

The civil defence organisation was quickly demobilised at the end of the war only to be re-established as the Civil Defence Corps in 1948 at the start of the Cold War. Initially, there was little difference between the organisation set up for World War II and the new Cold War but significantly for the history of the RSGs each region was now provided with a purpose-built and heavily protected Regional War Room (see www.subbrit.org.uk/rsg/features/war_rooms/index.html).

In the event of war, these would give the Commissioner a place from which to coordinate the civil defence operations organised again by the local authorities and based on the new volunteer Civil Defence Corps. The Regional War Rooms were designed with World War II conventional bombs in mind although when it became clear that the Soviet Union had atomic weapons the planners thought that the new Regional War Rooms, most of which were completed by 1955, would survive at least a nearby detonation. Then came the hydrogen bomb.

The explosive power of these new weapons would be measured in megatons – millions of tons of explosive. By comparison, the standard conventional bomb used during

World War II (and still today) had an explosive content of less than 1,000 pounds while the atomic bombs dropped on Japan had an average explosive power of some 15,000 tons of explosive. Put graphically, a conventional bomb could destroy a house, an atomic bomb could destroy a town but a hydrogen bomb could destroy a city.

The consequences of a Soviet attack on the UK using H-bombs were looked at by the Strath Committee in 1955. They considered the effects of only ten H-bombs each with a yield of ten megatons being dropped on British cities.

The immediate results in terms of death and destruction would be catastrophic but perhaps the main consequence would come from the new horror of radioactive fallout which would, in the words of the Committee's report, pin the survivors to their homes. Communications would stop, government would be impossible, the country would cease to exist as a coherent entity and the survivors would face what the 1955 Defence White paper would call a "struggle for survival of the grimmest kind".

Regional Government

It was immediately apparent to the experts and planners in the Home Office, Ministry of Defence and Cabinet Office who were responsible for civil defence that the existing plans and strategies would be utterly useless against the hydrogen bomb. Fortunately, a committee under Sir Thomas Padmore was already considering how the country should respond to an attack based on atomic bombs. They had recommended that a central seat of government should be set up at Corsham which, assisted by the regional organisation based on the Regional Commissioners, would deal with the effects of an attack whilst continuing to organise the nation's war effort.

But Strath now predicted there would be no war effort following an H-bomb attack, only a struggle for survival, and the Padmore committee reconsidered their ideas. What would become the Central Government War HQ at Corsham was largely unaffected but they revised their ideas about the "regional organisation". Now each Regional Commissioner and his staff would form a Regional Government and act, largely independently of any remaining central government, as the government for its region. And they would do this immediately the first H-bombs fell and not just, as in World War II, if communication was lost with the central government.

These radically new regional governments would need a headquarters not only with space to accommodate the expected four hundred or so staff but which was also protected or "hardened" against the new horrors of radioactive fallout. In addition to basic civil defence, the response to the initial attack would also now need to be much wider and would need a much more active involvement by the armed forces in support of the civilian effort. With this in mind the new Commissioner's headquarters would, in war, be co-located with the headquarters of the army district. This gave rise to the new headquarters being initially called "joint civil-military headquarters" although this clumsy phrase soon gave way to the simpler "regional headquarters".

The new regional headquarters would, where possible, use modified existing government premises although the expectation was that the majority would have to be purpose-built. They should also be in "reception areas" which were not expected to be directly attacked and as such would receive evacuees under the (largely hypothetical) national evacuation scheme.

Guidelines to the planners both of the headquarters buildings and how they would operate were drawn up in 1955. These showed a War Room redoubt which would have a Protection Factor (PF) of 1,000 (ie the effect of fallout would be 1,000 times lower inside than outside) together with unprotected office accommodation for the Commissioner's staff. A basement with a PF of 400 would act as a refuge for those staff who did not need to be constantly working and who consequently did not need a place in the redoubt.

Location, Location, Location

By early 1956 the Home Office's Regional Directors assisted by the army and the General Post Office had settled on their preferred general locations for the headquarters in England and Wales. The GPO would be responsible for planning the communications, mainly by telephone and telegraph, connecting the headquarters with other sites up and down the control chain. The sites chosen were:

Civil defence region	Location
North	Catterick area
North East	Harrogate
North Midland	Grantham
East	Cambridge
South East	Tunbridge Wells
Southern	Reading
South Western	Taunton
Midland	Shrewsbury
North Western	Preston
Wales	Brecon or Abergavenny

Shrewsbury and Taunton were chosen because the army planned to build new district headquarters in both towns. This decision was also influenced by the fact that the Regional War Rooms currently serving their regions (at Cheadle in Cheshire and Bristol) were in so called "evacuation areas" which were places expected to be at risk from either the direct effect of an attack or from the resulting fallout.

London region was a particular problem because of the size of its population and the range of economic and governmental activities found there. Problems were also envisaged if the Thames bridges were destroyed leading to communications difficulties between the northern and southern boroughs.

Regional War Room Cheadle, near Manchester – now demolished. Photo Nick Catford

Initially Dollis Hill was listed as the preferred location – perhaps at the World War II *Paddock* bunker – but the Civil Defence Staff College at Sunningdale was quickly added as an alternative. London was however not considered further and in 1961 it was finally decided that in the event of war it would be divided on a north–south basis and governed from the headquarters for the South East and East regions.

But almost as soon as these preferred areas were chosen some changes were made. It was realised that Harrogate was close to the Leeds/Bradford conurbation and likely to be affected by an attack on it, so was ruled out. The site for Wales was changed to Llandrindod Wells as it had better communications links than the previous two preferred areas.

In Scotland and Northern Ireland civil defence was not the responsibility of the Home Office and was organised locally. Armagh was the preferred area for the Northern Ireland Central Control and Lanark for the Scottish Central Control.

Ten-Year Plan

The new headquarters would be expensive and as civil defence budgets were very tight a ten-year building programme was envisaged. The first of the headquarters to be built would be in Shrewsbury and was scheduled to start in 1957, with work on the second at Lanark starting in the following year.

In the late 1950s the planners assumed they would have six months' warning of a future war in which to bring civil defence to operational readiness, but it was realised that even this time would not be long enough to set up the new regional headquarters. This was especially true for sites which would be completely newly-built. As a consequence, the Home Office's Regional Directors of Civil Defence were told to look for existing buildings, preferably government-owned, which could be pressed into service if a sudden emergency occurred.

By the end of 1956 possible sites had been found for all the English and Welsh "emergency headquarters". Four of them were in army barracks – at Catterick (using the Gaza and Sandhurst blocks) for North region; Shrewsbury (using Morfe-Radnor House, although this was described as being far too small, lacking a canteen or dormitories and with a ceiling which was not strong enough to take the weight of the sandbags necessary for fallout protection!) for Midland region; Preston (the Fulwood Barracks) for North West (although in the early 1960s the former bomb store site at Harper Hill near Macclesfield was considered as a possible site); and Brecon (Depot Barracks) for Wales.

The central range of the Sandhurst Block at Gaza Barracks, Catterick, site of RSG1 – now demolished

Four of the emergency headquarters would be based on existing, and newly finished, Regional War Rooms as follows: Nottingham for the North Midland region (although the World War II RAF site at Watnall was also considered as a possible site); Cambridge (East region); Tunbridge Wells (South East region); and Reading (Southern region).

Tunbridge Wells Regional War Room – now demolished. Photo Nick Catford

The War Rooms were however all too small to take the entire Commissioner's staff even after the nominal number of staff was been reduced to some 250. This lack of space would be 'solved' at each site by using six blocks of nearby TOBs or "temporary office buildings". These wooden buildings had been put up during WWII and would provide no protection against blast or fallout. To overcome this major deficiency the TOBs would be encased in a steel reinforced shell.

School's out

Two other buildings were identified at King's College at Taunton (plus the basement of the GPO building in the town) for the South West region and at Queen Ethelburger's Girls' School in Harrogate for the North East. But problems soon became apparent.

The two schools at Taunton and Harrogate were not owned by the government and so could not be fitted out in advance; in any event, nothing could have been done while they were still full of children. Moreover, Queen Ethelburger's Girls' School was in Harrogate which had already been rejected as a permanent location because of its nearness to Leeds/Bradford.

A possible alternative for this school was suggested at the Civil Defence School at Easingwold north of York. Another Civil Defence School at Falfield was mentioned as a possible replacement for King's College. It was also discovered that the site of the newly built War Room in Reading was only leased by the government and the lease would expire in 1968. This made it impractical as both the site of an emergency or a permanent headquarters.

Queen Ethelburga's school, Harrogate.
An unlikely early site for RSG2

However, nothing further happened for over a year in the planning of the emergency *or* the permanent sites because of a problem which would affect all civil defence plans throughout the Cold War – lack of money.

The exception was the permanent site in Shrewsbury. Planning for this site went ahead based on the proposed new army district headquarters building in the town but it was thrown into total confusion when the army cancelled its scheme. However, the Home Office found an alternative site at Drakelow near Kidderminster in Worcestershire. Here a series of tunnels had been dug out in WWII for use as an underground factory.

The factory had been cleared soon after the end of the war and the site was being used by the Ministry of Supply as a store. It did however have a large amount of space with existing catering and sanitation facilities. Telephone lines were already installed and it would give excellent protection against fall-out. But the site had already been designated as a reserve site to Corsham for central government use under the code name of *Macadam*.

A lot of debate ensued between the Home Office (responsible for the joint civil-military headquarters) and the Cabinet Office (responsible for central government protection). They reasoned that basing a regional emergency headquarters at the site would present a security risk to the central government facility but, on the other hand, it could help to camouflage it and joint use of some facilities would make both functions more economical. In the end, the central government facility was never started and the civil-military headquarters for Midland region alone was built at Drakelow.

It should be mentioned that at this time the main government emergency relocation site at Corsham was under construction and its plans included extensive communications links with the regional headquarters, although in reality, none of them existed.

Adit A, one of four access points into RSG 9 at Drakelow.
Photo Nick Catford

Berlin Crisis

In late 1957, possibly in response to the developing Berlin crisis, some money was found and plans were made to develop the emergency sites so that they could be brought to a state where they could be ready in seven days. This would involve for example building protective shells around the temporary office buildings. But, in practice, little was actually done.

A major civil defence exercise called *Cloud Dragon* was held in October 1959 and it simply assumed that all the original "permanent sites" existed. In reality, the old Regional War Rooms were used for the exercise. However, as a result of a rethink by the Joint Intelligence Committee in 1958, Nottingham was no longer regarded as a potential Soviet target. This allowed the War Room site there to be developed from 1959 and it appears that this was the origin of the "envelope" scheme under which the existing Regional War Room was incorporated inside a new structure which could house the entire Commissioner's staff.

RSG3 at Nottingham. The original Regional War Room is completely covered by the extension. Photo Nick Catford

The fundamental review of civil defence which reported to the Government at the end of 1960 argued that viable measures for the maintenance of central and regional government were vital if the country were to survive a nuclear war. It said that the emergency sites were all due for completion by 1961/62 (a rather unlikely claim) although the purpose-built sites were still required. The review did however result in a small increase in spending under what it called Programme X.

The Berlin Crisis which had been growing since the late 1950s came to a head in 1961, a year which saw the building of the Berlin Wall and US and Soviet tanks facing each other across Checkpoint Charlie. There was a real fear that the crisis could escalate into a nuclear war and it was a catalyst for the development of the emergency sites. By this time many of the substantial bunkers built for the RAF as part of the ROTOR radar scheme had become redundant providing the Home Office with a number of sites which already had a high level of protection and some, albeit insufficient, domestic accommodation and communications already in place.

The two-level semi-underground Ground Control Intercept bunker at Hope Cove in south Devon was acquired to replace the never developed King's College in Taunton to provide the emergency control for the South West. It was however too small to take even the reduced staff of 250 and the large, unprotected wartime "Happidrome" building alongside was also acquired to provide extra space.

War Room re-use

The emergency site at Reading was never developed possibly because of the problems with ownership of the site, and in 1961 a site was acquired at Warren Row some six miles away for the emergency headquarters. This used a former chalk mine which had been converted during WWII into another underground factory. After the war it was used as a store for museum exhibits by the Ministry of Supply.

The Regional War Room at Reading University was

Inside the tunnels of RSG12 Dover. Photo Nick Catford

however retained to serve as the communications centre for the main site although the two sites were only connected by vulnerable overhead lines. Using original War Rooms in this way was adopted at Warren Row and also at Dover because it would have taken both time and money to establish new direct telephone and telegraph links to the various places the RSG would communicate with, such as local authorities, police and Royal Observer Corps.

The original emergency plan for the South East region had been to use the Regional War Room at Tunbridge Wells augmented by some reinforced temporary office buildings. However by 1961 the tunnels under Dover Castle dug during the Napoleonic Wars – together with the additional lower level dug during the Second World War – had been acquired, but the site would use the Tunbridge Wells Regional War Room as its forward communications centre.

As well as the ROTOR site at Hope Cove two of the massive three-level Sector Operations Centres or SOCs built as part of the same network were taken over. The

Scottish Central Control at Kirknewton showing the original War Room in front of the later extension. Photo Nick Catford

one at Barnton Quarry near Edinburgh was acquired as a temporary site for the Scottish Central Control, taking over from the undeveloped barracks at Lanark while the Regional War Room at Kirknewton was being extended. Although the local planners in both Scotland and Northern Ireland would call their sites Central Controls rather than RSGs, they served the same function within the civil defence hierarchy as the RSGs in England and Wales.

North East Region finds a home

The vague plans for a site for the North East region headquarters had by 1960 moved away from using the civil defence school at Easingwold to using the Imphal Barracks at York and York Castle. The release of the ROTOR Sector Operations Centres allowed the one at Shipton a few miles to the north of York to be taken over. This had an advantage for the Home Office in that the Shipton site was already being used as a Sector Control by the Royal Observer Corps which was partly under Home Office control.

There was however a disadvantage in that the sector team had some sixty staff which greatly reduced the space available for the civil defence elements. As a result only the BBC and other communications staff would be based at Shipton with the remainder of the staff being based at Imphal Barracks.

Guardroom bungalow at the entrance to RSG2 Shipton, near York. Photo from Sub Brit collection

By the end of 1961 the plan to use "temporary office buildings" at Cambridge and Nottingham had been replaced by "envelope schemes" to extend the Regional War Rooms and construction work had been started. Some of the emergency sites were considered to be operational, or at least usable and, for example, Drakelow had been used during Exercise *Mercian Trump* although it would not be fully complete until the end of 1964. This illustrates a practical problem in dating these sites.

Home Office files tended to list them as headquarters as soon as they were adopted but it could then take many years (or never!) for the planning and design work. Then money had to be found and allocated to the budget for a particular year – only then could building work start. Although some could be used on an ad hoc basis after the building work was finished, fitting-out particularly of the communications equipment would take many more months.

However, by the end of 1961 the sites were sufficiently advanced for the Home Office to officially adopt the designation of **Regional Seat of Government** for all of them. This title, which had unofficially been in use for some time, was introduced to stress the role of the RSGs as centres of government rather than of civil defence activity.

All the RSGs were activated albeit to a limited extent for Exercise *Felstead* which was the national exercise held alongside the NATO-led Exercise *Fallex62* in the autumn of 1962. Some sites were however far from operational – for example the staff at Hope Cove were fed from a tent by the local WRVS. The barracks at Preston were not available and the Regional War Room at Cheadle near Manchester was used instead.

At the time of Exercise *Felstead* British strategy required that the RSGs should be fully operational at seven days' notice. Seven of the English and Welsh RSGs were thought to meet this target: Warren Row, Dover, Hope Cove, Drakelow, York (overflowing to Shipton), Cambridge and Nottingham (although the extensions at these last two were not complete and they could only house one hundred staff).

The initial conversion of Shipton was due to be completed in 1963 although a new fourth-floor extension was planned to take a further two years. The remaining three RSGs in the barracks at Brecon, Preston and Catterick would require more than seven days to improvise the protection although the protective materials were held on site.

RSG4 at Cambridge showing air galleries projecting from the roof of the original Regional War Room in front of the later extension. Photo Nick Catford

Cuban Missile Crisis

The Cuban Missile Crisis of October 1962 showed that a nuclear world war might start with less than the anticipated seven days' warning and the planners decided that the key parts of the civil defence organisation, including the RSGs, should be capable of being made

operational within two to three days. This led to an acceleration in the building programme for the RSGs but it was obvious that only Nottingham, Cambridge, Dover and Kidderminster could meet the new timetable and in 1964 the idea of building some purpose-built sites was reintroduced.

Regional War Room, Reading. Photo by Nick Catford

These would replace the barracks at Brecon, Preston and Catterick with the favoured areas being around Llandrindod Wells, Lancaster and Hexham. Hope Cove was too small and not considered a suitable site for development for financial reasons, and interest returned to finding a site in Exeter or Taunton with Norton Manor Camp in Taunton being favoured.

The barracks at York which were due to take half the RSG's complement as well as requiring ad hoc reinforcement against fallout were by now scheduled to be demolished. The purpose-built RSG would now be constructed on the site of the former ROTOR SOC. It would be built on the surface but connected to the underground SOC.

RSG 7 Hope Cove, Devon. Photo from Sub Brit collection

Confusingly, it appears however that the planned new fourth floor at the SOC was considered to be part of the emergency RSG rather than part of the new permanent building. The Southern region RSG at Warren Row/Reading was considered to be particularly bad as it was split between two sites, neither of which was really suitable.

In mid-1964 tenders were issued for six purpose-built RSGs to replace Catterick, Shipton/York, Hope Cove, Warren Row, Preston and Brecon. But the plans immediately ran into budget constraints and a battle developed between the Home Office (for) and the Treasury (against) which was finally decided by Prime Minister Harold Wilson who ordered that they should be deferred yet again.

This left the Home Office with an eclectic collection of RSGs. The barrack sites at Brecon, Catterick and Preston were generally too small and lacking in basic facilities. Their main disadvantage however was their lack of protection against fallout. Protection against blast was not considered for the RSGs although nominally they were supposed to be able to withstand an over-pressure of 1.5 psi. The main concern was fallout and target PF of 400 was often mentioned for the RSGs.

To complete the necessary ad hoc protection against fallout, mainly by sandbagging windows and floors, would require an estimated 17,500 man-hours at Brecon, 30,000 at Catterick and 35,000 at Preston. On this basis preparations at Preston would have taken a complete infantry battalion a week to finish. Given the situation which would have existed at the time this does not seem a practical possibility.

Tight Squeeze

The accommodation at Preston was also inadequate and a third as yet unallocated building would be needed. By this time the North East RSG had probably moved away from the Imphal Barracks in York to be based solely on the SOC at Shipton which even with a fourth floor would have been a squeeze for the nominal 450 staff of an RSG.

The former ROTOR bunker at Hope Cove, although very

well protected, was also too small even if the adjacent Happidrome building were pressed into service. It was also considered to be in a remote area with poor road and communications links.

In the Southern region, while some of the staff would have enjoyed the protection of the former Reading War Room, at least half would have been based in the tunnels at Warren Row which a report prepared by the Home Office in February 1965 described as "...unhealthy, unsafe and said to be a fire hazard. The generating plant is of doubtful efficiency and too small in capacity; the ventilation system is old and internal temperatures cannot be controlled. Communication links to the War Room are by overhead line and are vulnerable."

This left just four sites which were considered to be adequate and intended to be long-term RSGs. The tunnels at Drakelow were complete and provided a good standard of accommodation. The envelope schemes which extended the War Rooms at Nottingham and Cambridge were nearly complete although Nottingham would still need some extra space. In the Southeast the Dover site was still in need of some major adaptation but completion was due by March 1966. Even then it would need to use the Tunbridge Wells War Room as a communications hub.

Brecon Barracks, site of RSG8

Food for Thought

These considerations, however, only related to the physical infrastructure of the RSGs. Many other things would be needed if they were to function properly and these were often lacking. The most obvious problem was the staffing situation.

Although complete lists of designated staff had been compiled for each RSG, apart from a few of the most senior people none of them had been told of their wartime roles, they had received no training and the last exercises for RSGs were held in 1962. As well as basic manning, the question of what to do with the families of the staff once they had joined the RSG was always considered to be a very serious one but was constantly fudged and never solved.

Problems about where the food would come from to feed the embunkered staff for the suggested thirty days that they would be incarcerated were also never satisfactorily resolved. Perhaps more importantly, the rest of the civil defence organisation such as the Civil Defence Corps, the emergency feeding organisation and emergency medical services which the RSGs would rely on to put their governmental announcements into practice, did not exist in any credible sense.

Entrance to Fulwood Barracks Preston, site of RSG10

The End is Nigh

But then a more serious problem emerged. For many years the Joint Intelligence Committee had been preparing assessments of which places in the UK would be attacked by the Soviet Union with nuclear weapons. Up to 1964 these assessments excluded the RSGs on the basis that they were only related to civil defence and would not pose a threat to the Soviets. However, by early 1964, probably as a result of the leaks by the *Spies for Peace*, they were included as probable targets.

This caused consternation amongst the civil defence planners at the Home Office who now had to face the assumption that the RSGs, the planned linchpins of regional and national civil defence, would be attacked and destroyed at the start of any future war. This led to considerable debate about the practicality of retaining the RSGs which the Home Office lost, and in 1965 it was publicly announced that RSGs as permanent pre-planned facilities would be abandoned.

Now, instead of sending some 450 staff to a pre-established and well-equipped RSG in the transition to war period, only the smaller (and in many cases non-existent) Sub-Regional Headquarters would be manned pre-attack to coordinate the initial civil defence effort. The Regional Commissioner would base himself at one of these but he would not have a role until some time after the attack when together with his staff of around 250 – who had been dispersed around the region in hotels, prisons and the like – he would emerge to set up a Regional Seat of Government at a convenient location.

Thus the idea of an RSG occupying a special prepared site was abandoned and the era of the RSGs came to an end.

Sapperton Canal Tunnel

Jonathan Maisey

1400 metres in from the Tunnel House portal, the Sapperton canal tunnel passes through the first of two bands of unstable fuller's earth. This section of the tunnel has suffered from numerous collapses as the reinforced triple-layer brickwork lining has failed to hold back the combined pressure of fuller's earth and water action.

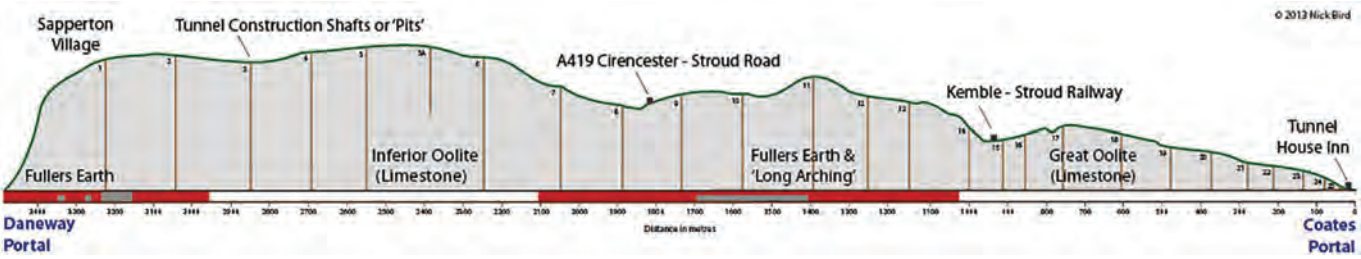
'Cotswold Canals' is the title given to two connected Gloucestershire waterways, the Stroudwater Navigation linking the river Severn to Stroud and the Thames & Severn Canal, linking Stroud to the river Thames (via the Sapperton canal tunnel). The Stroudwater Navigation was built between 1775 and 1779 and from the beginning it was very profitable. This success ensured that there was support for the inclusion of the route into part of the proposed link with the river Thames and thereby with access to London.

Thames and Severn Canal

In 1781 Robert Whitworth, probably the most outstanding canal engineer of the day, was commissioned by the promotors of the Thames & Severn Canal to identify a suitable route for the canal and its connection to the river Thames. There was however one major obstacle to the extension of the canal, the high ground of the Cotswold escarpment lying to the east.

In addition to this, Whitworth had also not been given any guidelines as to the width of the canal. This was important given the three different sizes of vessels that were expected to use the route between the Severn and the Thames: the Severn trows (68ft long x 15ft wide), the Thames barges

Postcard of the entrance to Sapperton tunnel with a view from a watercolour shortly after the canal had been completed



(90ft x 12ft) and inland waterway 7ft-wide narrowboats. Whitworth assumed that the dimensions required related to the Thames barges and that transshipment at some point along the link would be necessary. His assumption was that although the vessels of the Thames would be able to navigate the waterways used by the wider Severn trows, the reverse would not be possible.

The report recommended a route from Stroud to Cirencester. However the surveyor, Robert Whitworth, warned that trouble would be encountered on the summit (of the escarpment), which was to be built over "bad rocky ground". This warning proved to be well-justified as once the canal had been built, subsequent efforts to retain an adequate supply of water within the section to the east of the tunnel proved difficult. The need to repair water leaks within the canal and maintain an adequate water level was to be a constant and expensive problem for the canal owners over the life of the canal.

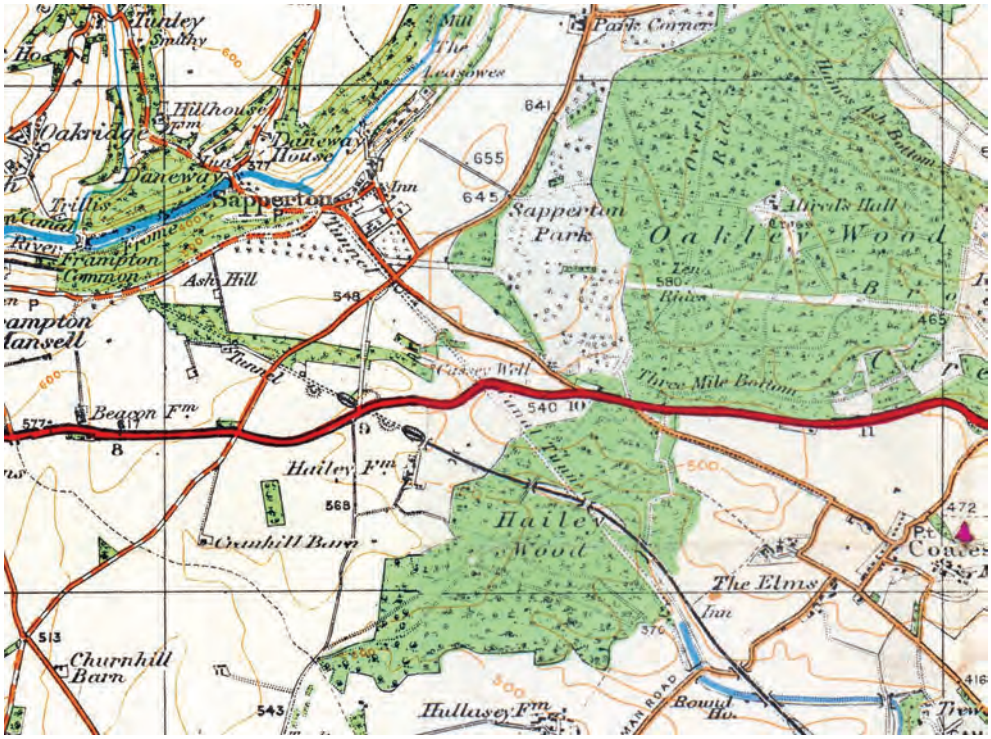
Threat from the railways

The first boat passed through the tunnel to Cirencester in April 1789. The efficiency of the canal was marked by steadily increasing receipts, peaking in 1841. However, competition from the railways was growing and by the end of 1893, a notice was issued closing the canal east of Stroud until further notice.

Regarded by many locally as an indication of imminent permanent closure, this stimulated the formation of a Trust consisting of six other canal companies and five local authorities. Money was borrowed to finance major repair works and the entire canal length was reopened in March 1899. This however proved to be short-lived and the canal was soon to close again.

In 1900 Gloucestershire County Council assumed management of the canal and a programme of remedial works was undertaken in order to prevent the water leaks. In 1904 the narrowboat *Staunch* successfully delivered a cargo of coal to Cirencester. Although this was celebrated and despite the repairs to the canal, little traffic was using the canal from the tunnel eastwards. In 1912 most of the staff east of Chalford (effectively covering the tunnel eastwards) were laid off and the long decline set in with little or no trade through the area.

Labourers working on the canal at Blue House Reach at Siddington in 1904 in the process of puddling or making the canal base watertight through the use of a clay mix

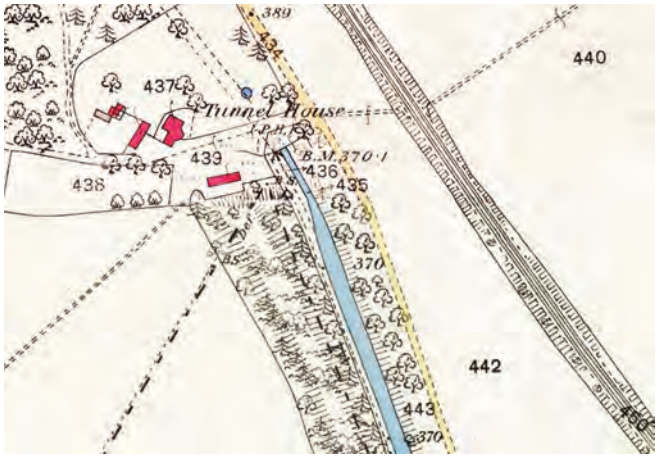


In 1972 a group of enthusiasts held a meeting in Stroud with the idea of restoring the disused and overgrown Stroudwater canal and reopening access to Stroud from the Severn. From this meeting a group was formed, the Stroudwater Canal Society. However, many of the group's members wanted not just to reopen the link to the Severn but also the whole canal route through to the Thames.

The society later sought trust status, becoming the Stroudwater, Thames and Severn Canal Trust and now is known as the Cotswold Canals Trust.

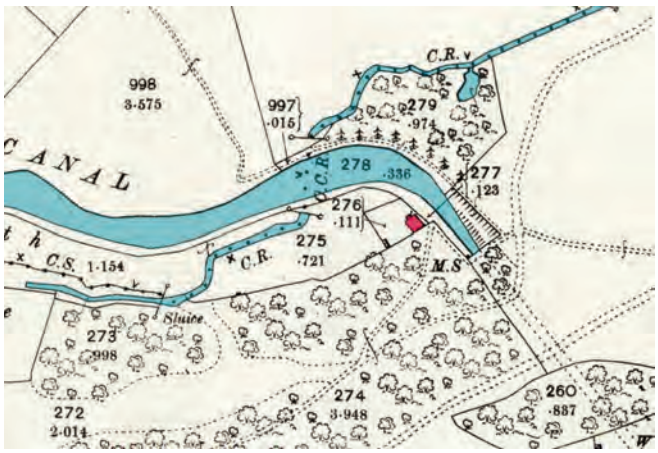
Sapperton Tunnel

Having taken five years to build, the Thames and Severn canal finally opened in 1789 and, at Sapperton, boasted the longest and largest canal tunnel in the world at the time. Work to build the tunnel started in 1784 and, after problems with the difficult ground and an incompetent contractor, was completed in 1789. It is over two miles long at 3,817 yards (3,490 metres or 174 chains) and approximately fourteen feet wide by fifteen feet high. It was dug using a method of sinking 25 shafts to a pre-determined depth and then connecting them altogether to create the single tunnel.



In places these shafts are 200 feet deep; most are now capped or filled in and none has access into the tunnel itself. It is said that when the tunnel was in operation, it was possible to see right through the tunnel from one entrance to the other. Even to this day, its length has only been exceeded by two other canal tunnels in England.

Obstacles encountered during the construction of the tunnel (and still causing problems today) are the bands of fuller's earth which the tunnel and its shafts are cut through, and the various springs that pour water into the tunnel. When wet, the fuller's earth expands and creates pressure against the canal walls. To counter this pressure a thick layer of triple-brick arching was built to line the



tunnel where it passes through the bad ground of the fuller's earth. The expansion of the fuller's earth also forced up the bed of the canal in places.

In the areas where the tunnel passes through the local limestone, the permeable nature of the rock also allowed for water leakage. In one section of the tunnel, springs were constrained by a concrete wall and glazed eight-inch pipes (photo bottom left) in order to prevent erosion of the wall. In loose rock, the brickwork arch was continued down to the tunnel floor and even across the canal bed. The gaps between the walls and rock were sealed with clay.

Clay was also rammed into the joints of the more stable formations and held in place by walling and later by 160 oak 'doors' slid into grooves cut in the rock. In places, timbers were laid across the floor of the canal in order to keep the walls from bowing in. In the summer or in drier weather, the springs that enter the tunnel and used to maintain the water level would become 'drain holes', adding to the problems of retaining water in the tunnel.

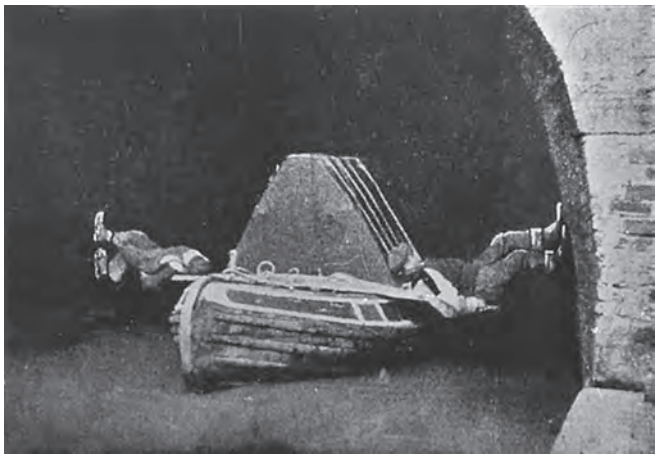
The Daneway portal of Sapperton Tunnel c. 1910. The lengthman's cottage on the right fell into disrepair and was demolished in the 1980s

Navigating the tunnel

To start with, entry to the tunnel was restricted to fixed times on a four-hour cycle through the day and night. Access arrangements did vary over the years however. For example, in 1904 the arrangements were quoted as boats entering from the west end at 12 noon and the east end at 7am and 6pm. There being no towpath within the

tunnel, barges were 'legged' through the tunnel, on the roof or against the sides of the tunnel. This was easier on the wider Thames barges but on the smaller narrowboats was more difficult and necessitated the use of planks protruding from the sides of the boats on which the leggers were able to lie. The use of bargepoles against the tunnel sides was forbidden.

While the boats made their slow journey through the tunnel, their associated horses/donkeys were walked overground to the other portal. A barge entering the tunnel from the western (*Daneway*) portal and going against the flow of water would complete the traverse of the tunnel in about five hours. In 1904 the *Staunch* was reported to have taken three and a half hours using 'tunnel sticks' (which had previously been forbidden) to travel the length of the tunnel.



Leggers lying on planks protruding from the sides of the boat 'walk' the boats through a tunnel

The tunnel today

Although extensive sections of the canal network have been restored since the early 1970s, other than work to both tunnel entrance portals, the tunnel has not been touched. It is possible to enter the tunnel at both ends, but due to heavy roof falls it is no longer possible to traverse the entire length of the tunnel.

Over a number of visits in 2014 and 2015 members of the Gloucester Speleological Society explored the entire length of the tunnel in order to record its current state of preservation and take photos where possible. The visits were also helpful in that valuable experience gained was subsequently passed onto the local cave rescue team (Gloucestershire Cave Rescue Group) in order that a plan could be made should the group ever be called out to the tunnel.

The Eastern portal (bottom left) is located close to the *Tunnel House Inn* (above). The inn was originally built to house some of the workers digging the tunnel. In 1790, after the tunnellers had left, it was licensed as the *New Inn* and it was only later that it became the *Tunnel House*.

The tunnel has numbered metal markers attached to the wall representing the surveying 'chain' tags (photo above) ranging from 1 (starting at the *Tunnel House* entrance) through to the final marker, 174 at the *Daneway* entrance. During our first visit to the tunnel in September 2014 it was found that the tunnel was in good condition (picture top of next page) as far as the first of the collapses through the section of soft-grey shale material, located approximately 1400m in from the entrance and close to chain marker 71.

It had been thought that the traverse of the tunnel would be quite an easy walk, however trying to walk through often knee-deep mud and deeper water to reach the first collapses took a lot longer than expected and was quite tiring. At this point it was proposed that any return visit would involve the use of kayaks or inflatable boats.

From the first blockage onwards, the series of roof collapses was in the region of a few hundred metres in length and separated by sections of deep water (picture below) before finally emerging once again into open passage and yet more deep mud to wade through. Pressing on, the tunnel appeared to be never-ending and we were wondering just how far we'd need to go to get to the final collapse.

Eventually one of the party reached the collapse and reported back that although the tunnel was completely blocked by the roof fall there was a small black hole at the top of the collapse located next to a large boulder of clay/fuller's earth, all very unstable. It had already taken us two hours' hard slog to get to this point and would therefore take us another two to get back out, so we decided to call it a day. We would return with inflatable boats to take a closer look at the hole and take some decent photos of the tunnel.

Return Visit

In December 2015 two of us returned to the tunnel armed with inflatable boats and a camera. Being able to drift along easibly in the boats and in the dry (still wearing wetsuits though) made all the difference and meant that we could pay more attention to the features as we passed them, make notes and take photos. One disadvantage of trying to take photos in the tunnel is that because the floor is totally flooded (as intended!) and there is no walkway,

there is literally nowhere dry to put down any equipment at all, making photography a tricky business.

After about 920 metres, we identified a shaft (picture above) in the roof of the tunnel that we could see had been capped at the surface. Once within the series of collapses we took a closer look at the fuller's earth/clay in-fill collapses and the three layers of brickwork that the tunnel had been lined with (picture below).

Within the collapsed areas we came across a painted 'Half-Way' sign which was close to chain 86 (approx 1730m in) and therefore did actually represent the half-way point of the tunnel. Also within this area we came across some curious 'O' and 'S' signs which we were eventually to identify as referring to the floor-level timber reinforcing from wall to wall ('O') and the brick knee-high buttress supports ('S'), all hidden under the water.

Once out of the collapse series we were into open passage and soon came across more of the timber beams that had been placed across the floor in order to try to prevent the walls from bowing in (picture top of next page). Between chain markers 101 and 104 (between 2031m and 2092m from the entrance) we came across one of the major springs that pour water into the tunnel. This spring is probably located at one of the fault lines that exist within the tunnel and between the various rock strata. Finally, just beyond chain marker 153 (approx 3077m in) we arrived at what was to prove the final collapse.

the collapse was a void, made by the collapse of the ceiling but nothing else.

We were convinced that given the unstable nature of the fuller's earth/shale sections, this collapse had moved since our last visit just over a year earlier. At some point in the future we may return to the collapse just to see by how much it has changed. Given that the collapse was just beyond chain 153 and the tunnel was 174 chains in length we would need to take a look at the other end of the tunnel in order to try to work out how thick the collapse may be and whether there could still be any sections of tunnel closed off by the roof falls.

On the earlier visit we'd been told that there had been a black hole at the top of the collapse (picture above), which could lead into more tunnel, and also a large boulder partially blocking the way on. Examining the collapse we could find no sign of either a large boulder or a black hole leading to who knows where. At the top of

Western (Daneway) portal entrance

The western portal (picture bottom left) also shares its name with an inn – in this case the nearby *Daneway Inn* (picture below), built in 1784 to act as a base and provide accommodation for the men working on the construction of the canal. In 1807 it was sold by the canal company and renamed the *Bricklayers Arms*, becoming the *Daneway* in 1947.

Over a number of visits between 2010 and 2016, the *Daneway* end of the tunnel was investigated and found to be much easier to traverse than the *Tunnel House* end. For around the first 200 metres the tunnel is in good condition and completely lined in brick, with a few interesting features on the way, including chain markers and what appeared to be some form of vent (picture top of next page). We've no idea what this was for and have yet to find a corresponding hole on the surface.

The first collapse is soon reached and the fact that it is covered in calcite suggests that this has been here for quite some time. From this collapse it is possible to see the next collapse and the final collapse just behind.

Unfortunately, due to the blockages in the tunnel the water level between the collapses here is much deeper than at the entrance part of the tunnel and wetsuits are certainly recommended. The second collapse (picture above) is also covered in calcite and partially blocks the tunnel. The final end collapse (picture below), also calcified, is located a short distance further on and totally blocks the tunnel.

Chain 166 is the closest chain marker to the end collapse and given that a chain is 66 feet, we think therefore that chain 165 must be not far into/under the end collapse. This would then mean that the potential length of the tunnel blockage is therefore (approx) from chain 153 (at the Tunnel House end) to chain 165 at the Daneway end, a distance of approx 790ft. Given that nearly 800 ft is a long section of collapse, this does raise the possibility that there is/are still sections of the tunnel undamaged but sealed off between the two end collapses.

The restoration of Sapperton Tunnel is entirely feasible from an engineering standpoint. As might be expected, though, this would be the most complex and expensive single element of the Thames & Severn Canal restoration.

Links:

www.cotswoldcanals.com/

References:

David Viner, *The Thames and Severn Canal, History and Guide,* Tempus Publishing Ltd ISBN 0-7524-1761-4

Graham Hobbs, *Sapperton Canal Tunnel,* Burcombe Publishing, ISBN 978-0-951422-5-3

All recent photos by Jonathan Maisey

Subterranea Index

Linda Dixon

We have been publishing Sub Brit's magazine ***Subterranea*** since January 2003.We have now published 40 volumes (this is the 41st) and with around 60 pages per magazine, that's 2,400 pages of information about underground sites; and with an average of eight main articles per issue, that's 320 big chunks of information along with about eight pages of News per issue – so 320 pages of useful snippets.

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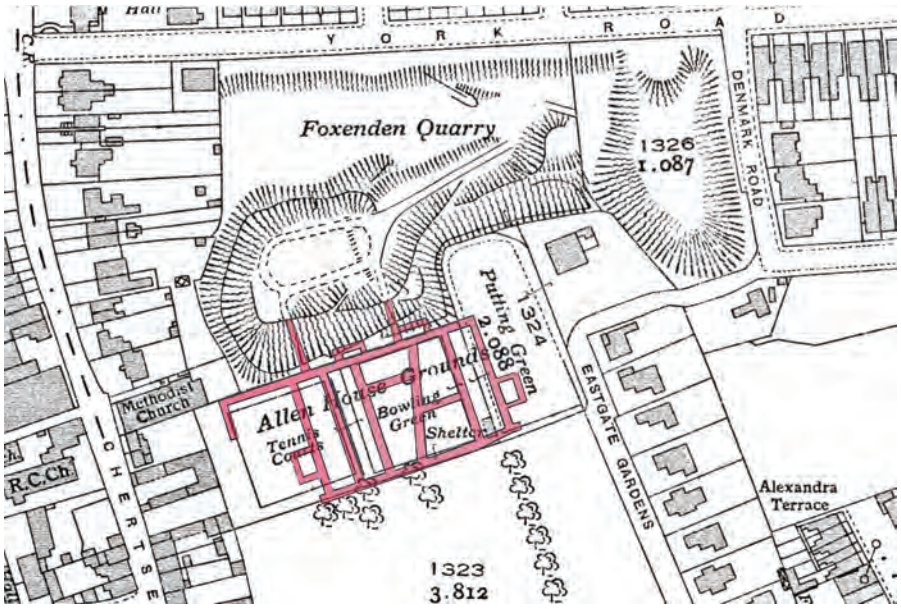
If you have any queries, then email publications@subbrit.org.uk

Foxenden deep air-raid shelter, Guildford, Surrey

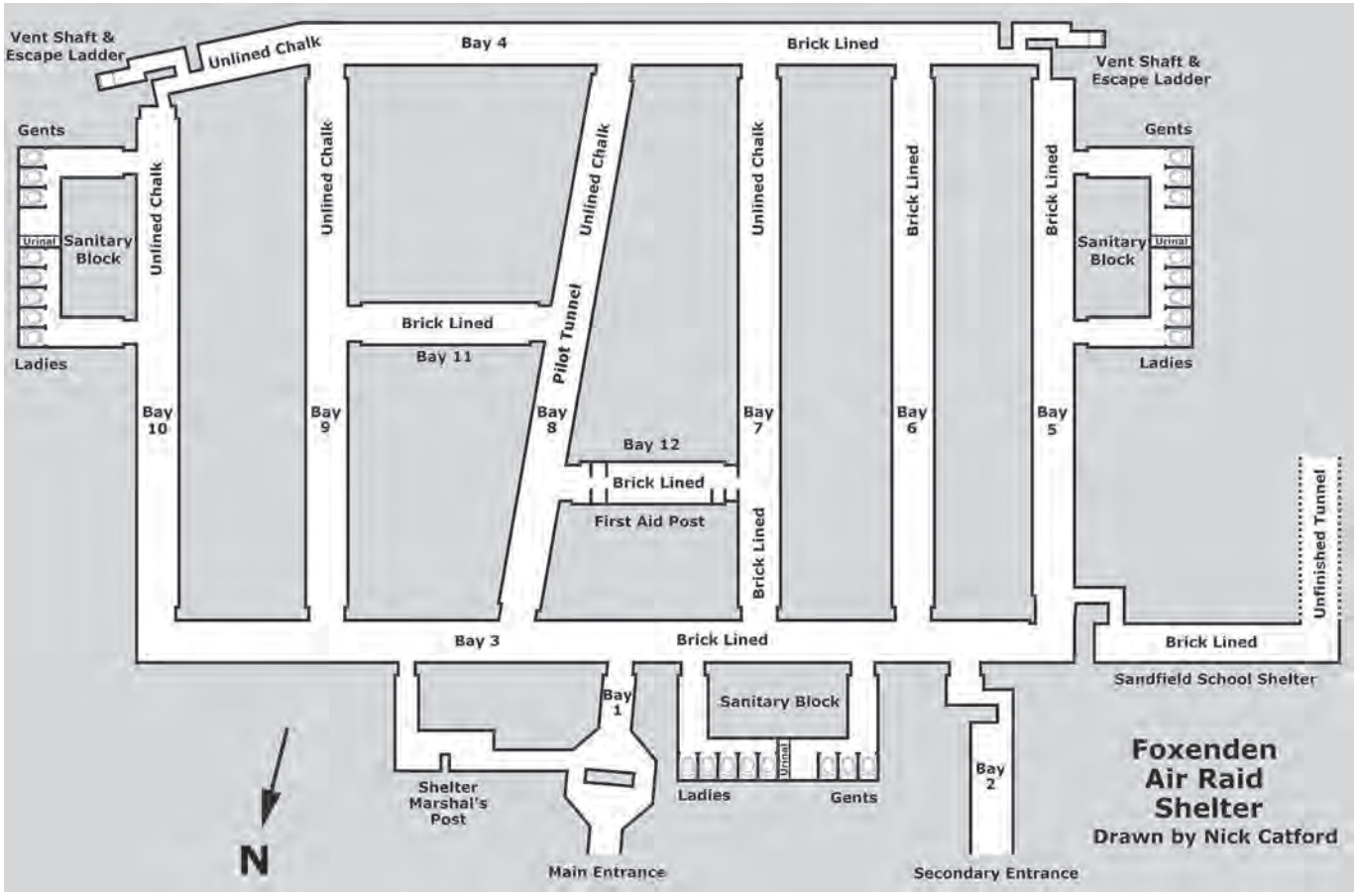
Paul Sowan

Looking south along bay 7; the north end of the bay was brick-lined. The first-aid post is seen on the left. The circular holes at roof level were for the ventilation trunking; this was all removed: for scrap after the war. Photo Nick Catford



Shelter tunnels overlaid on to1938 1:2,500 OS map. The shelter is under the tennis court, bowling green and putting green in the Allen House Grounds

During World War II the Borough of Guildford excavated a deep air-raid shelter below Allen House Gardens, with entrances tunnelled southwards from a disused chalk pit at a lower level on the south side of York Road. The locked entrances can be seen at the lowest level of the multi-storey car park now sited in the pit, as can two brick-built stairheads with concrete slab roofs in the gardens. This deep shelter was additional to the five Surrey County Council



shelters tunnelled into the chalk of the North Downs described in *Subterranea* issues 33 and 34 in 2013. Presumably, if for no other reasons, the Racks Close quarry tunnels to the south of the town centre in Quarry Street were not so used as the Foxenden site was very much more readily accessible to the town centre and to residential properties north of the High Street.

The shelter and its history have been described in a slender self-published pamphlet (2007) by Helen Chapman Davies. She has drawn on sources in the Guildford Borough Archives and the Surrey History Centre, and visited the shelter personally. Jane McGregor of Subterranea Britannica is thanked for her assistance. A shorter account is also published in her book *Guildford's hidden history* (2010) which has photographs of the substantial brick and concrete ventilation shaft / emergency exit surface structures in the gardens, and a clearer plan of the shelter tunnels than appears in the pamphlet. What follows is based on Davies' published accounts, with some additional observations.

YOU HAVE BEEN WARNED!

The present immunity from Air Raids may well be the Calm before the Storm.

Remember your nearest Public Shelter.

PUBLIC SHELTERS

Foxenden Quarry (Trenches).
Old Theatre, Lea Pale Road.
Borough Hall, Haydon Place.
The Playhouse Arcade, High Street.
The Angel Hotel, High Street.
The Ward Street Hall.
The Public Reference Library, Ward Street.
The Public Baths, Castle Street.
The Glass Works, Portsmouth Road.
The Old Technical Institute, Park Street.
Upper High Street Car Park (Overground).
Tunsgate Car Park (Overground).
Castle Grounds (Overground).
Onslow Street Car Park (Overground).
Cattle Market Car Park (Overground).
Station Meadows, Woodbridge Road (Overground).
Clock House, Onslow Street (Basement).
Cellars at North Street end of Angel Gate

On no account will the Public be allowed to take animals, bicycles or perambulators into the Shelters, and therefore it is desirable that animals should not be brought into the town.

Inspect and wear your Gas Mask at least once a week

Guildford, it seems, was not seen as a town at great risk from bombing, although it has an important railway junction on the lines from London to Portsmouth and from Aldershot to Folkestone and Dover. Davies noted that the Borough Council records list 75 bomb incidents from 29 August 1940 to the end of 1944, resulting in seven deaths.

Already by 1938 the local council had constructed trench shelters for 2,490 persons at the Foxenden quarry (chalk pit), Racks Close public open space, and a site referred to as The Firs. The Racks Close trenches were soon abandoned and backfilled, and no thought appears to have been given to the use of the nearby quarry tunnels for sheltering. The trench shelters in the Foxenden chalk pit were later taken over by Sandfield School for their pupils and were damaged by a bomb on 29 September 1940.

Tunnelling begins

The decision to create a deep tunnelled shelter at the chalk pit in York Road was taken on 5 October 1940, when the

Borough Surveyor was instructed to prepare plans. This shelter was to have places for 1,000 persons and to be equipped with bunks, lighting, ventilation, sanitation and first-aid points. Tenders for a length of trial tunnel were invited on 8 November the same year, it being resolved to proceed with a completed shelter only if the stability of the chalk proved satisfactory.

At the time there was a proposal for a new and partly subterranean road passing through this location and under the town centre, which subsurface highway could, if built, accommodate a further 2,500 persons while the war continued. In the event, no such tunnelled highway was made. Although this abandoned scheme is only mentioned in one official document, it is thought to be the reason why one of the tunnels in the shelter is at an angle (lying on the suggested road alignment) to the rectilinear grid pattern of the rest.

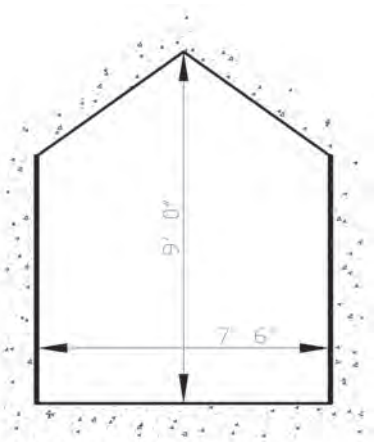
There are no known photographs of the shelter during WWII. This is one of the entrances in the quarry face in 1953

The tunnelling contract was let to J.B. Edwards & Co. (Whyteleafe) Ltd. The scheme was approved on 3 March 1941, and work appears to have been completed by the end of that year at a cost of £5,000. Foxenden was one of 18 public air-raid shelters in the area built by the Borough Council; many of the others were, however, little more than converted basements.

The plan of the shelter comprises two long parallel east-west tunnels, one a few yards back behind the chalk pit face, and another some way further south. Linking these at right angles (the pilot tunnel excepted) were six north-south tunnels. The second, third and fourth tunnels from the east end were connected by offset link tunnels. Small tunnels for sanitary purposes equipped with Elsan-style chemical toilets were also provided off the easternmost, northern, and westernmost galleries. Two entrances / exits opening into the chalk pit each had anti-blast dog-legs in them. Most of the shelter lies some 48 feet below the public gardens. A short unlined extension apparently westwards from the west end of the north gallery was made at the request of Surrey County Council on 21 March, although for what purpose is apparently not recorded.

The unfinished tunnel at the end of the Sandford School bay. Photo Nick Catford

The galleries have concrete floors. The original plan envisaged that the chalk would be stable enough not to need lining, a budgetary bonus, but in the end some sections had to be lined with brickwork or concrete. These must have been the most popular sections to shelter in as it was these sections that are thought to have had tubular heaters when they were installed in 1943. Where brick lining was required, it comprises two courses of bricks. The rear course on each side is slightly higher than the front course providing a step on which the sharply angled 'V' shaped concrete roof rested. This provided an inherently strong structure. The void above the roof was then packed with spoil to further strengthen the shelter. The galleries are about six and a half feet wide, and from eight to nine and a half feet high. Painted notices survive on the walls, identifying tunnels by numbers and the shelter marshal's location and first-aid point.



TUNNEL SECTION
Not to Scale

Looking north along bay 7 and the junction with bay 12, the first-aid post. Note one of two toilet cubicles in bay 11. The distinctive 'V' shaped concrete roof rested on the front course of bricks on the side wall and provided an inherently strong structure. Photo Chris Rayner

Two vertical narrow circular-section 48-foot ventilation shafts fitted with steel escape ladders communicate to the stair-heads in the gardens above. These shafts were fitted with electrically driven fans. A telephone was installed in June 1942 but the installation of heating and ventilation was not proposed until December 1942, by which time the worst of the air raids was over.

The shelter plan, redrawn and reproduced on p. 54, identifies the bay numbers, locations of the three 'sanitary blocks', shelter warden's post and the first-aid post which was the only part of the shelter with mains water. Also shown is the brick-lined bay allocated to the nearby Sandfield School, and the unfinished southerly extension from the inner end of the latter.

The entrance to the shelter marshal's post seen from bay 3. Photo Nick Catford

The shelter was kept locked other than when the air-raid sirens were activated 'because of cases of unsuitable behaviour'. Access was by tickets bearing the holders' national registration numbers, names, addresses, and bay and bunk numbers. Tickets (at least one of which survives) were not transferable. Overnight shelterers were required to take their own bedding underground with them, and to remove it again when exiting the shelter. Two-tier bunks were provided along each wall leaving a narrow walkway between them.

Other uses

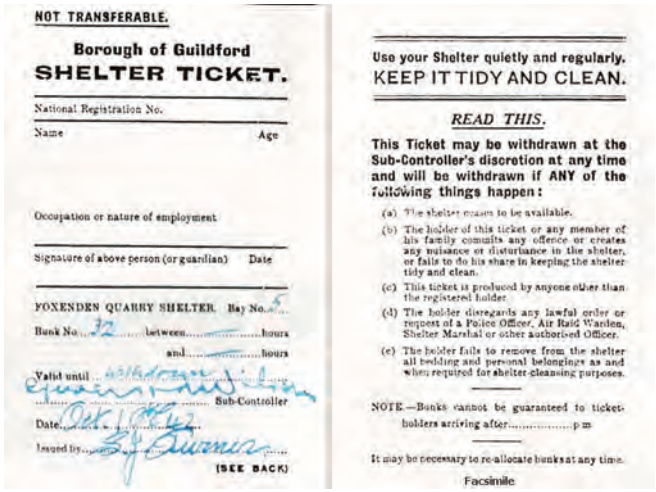
At various times during the war parts of the shelter were used in invasion defence exercises. In May 1942 the site was designated as a post-invasion Nodal Point headquarters. Part of the shelter was used as a food store in late 1942 and in March 1943 it was proposed to convert a part of the shelter into a Civil Defence Corps reporting centre but this never happened.

On 10 October 1944 it was decided that the shelter would close as it was then little used and it was too costly to run the heating and ventilation and to pay cleaners to empty out the toilets. The shelter closed for sleeping purposes from 20 November 1944. In 1945 it found a new use as a Ministry of Supply store, but by the 1950s was sealed and forgotten.

On the afternoon of Thursday 3 September 1970 the shelter briefly made news. A 13-year-old girl was playing with another girl and two boys by the Allen House putting green. They found a small brick building where someone had removed a few bricks. The girl squeezed through and immediately fell down the ventilation shaft into the shelter, breaking a leg, foot, wrist and rib. Firemen opened the doors to gain entrance to the shelter from the old chalk quarry and took her to hospital. All entrances were then resealed.

The bottom of the west ventilation /escape shaft. The ladder is still in good condition but is capped at the top. Note the sump at the bottom of the ladder. The circular hole on the right allowed the ventilation trunking to bypass the dog-leg in the passage. There was a fan mounted here. Photo Nick Catford

The York Road multi-storey car park was built close to the chalk pit face in the 1970s, when it was decided to use the shelter as a drainage soak-away, but unwanted water was diverted back outside in 1990. The car park has encroached on the first part of the two access tunnels into the shelter and two new doorways have been installed in the southern wall of Level 1. Helen Chapman Davies reports finding no evidence for any suggested Cold War role for Foxenden. There are detailed explanatory plaques displayed on the surface structures in the gardens above the shelter.



NOT TRANSFERABLE.

Borough of Guildford

SHELTER TICKET.

National Registration No.

Name Age

Occupation or nature of employment

Signature of above person (or guardian) Date

FOXENDEN QUARRY SHELTER Bay No. 5

Bunk No. 72 between hours

and hours

Valid until

Sub-Controller

Date

Issued by

(SEE BACK)

Use your Shelter quietly and regularly.

KEEP IT TIDY AND CLEAN.

READ THIS.

This Ticket may be withdrawn at the Sub-Controller's discretion at any time and will be withdrawn if ANY of the following things happen:

(a) The shelter ceases to be available.

(b) The holder of this ticket or any member of his family commits any offence or creates any nuisance or disturbance in the shelter, or fails to do his share in keeping the shelter tidy and clean.

(c) This ticket is produced by anyone other than the registered holder.

(d) The holder disregards any lawful order or request of a Police Officer, Air Raid Warden, Shelter Marshal or other authorised Officer.

(e) The holder fails to remove from the shelter all bedding and personal belongings as and when required for shelter-cleansing purposes.

NOTE.—Bunks cannot be guaranteed to ticket-holders arriving after p.m.

It may be necessary to re-allocate bunks at any time.

Facsimile

Visit by Sub Brit

When visited by members of Subterranea Britannica in July 2001, the shelter was found to be generally in excellent condition throughout although there was a little water on the floor in places. The only section that doesn't have a concrete floor is the short unfinished tunnel where there is a very claggy chalk floor with a number of timber props supporting the roof still in place. There is evidence of fixing for bunks along both walls of all the tunnels leaving a narrow corridor in the middle. Some wiring, fuse boxes and electrical fittings remain in place.

There are three pairs of male and female toilets, one in the northern east-west passage and in the two end cross-passages. The ladies toilet consists of a number of cubicles with chemical toilets still in place and each male toilet also has a urinal at the far end. There were also two toilet cubicles in thr first-aid post and the mounting for a sink was also noted.

One of the ventilation fans at the south end of bay 5. Heating and ventilation was installed in 1942 at a cost of £172.12s

Looking west along bay 4 towards one of the ventilation shafts. Straight ahead leads to bay 9 which is at right angles. A dog-leg tunnel to the left leads to the shaft. The sign leaning against the end wall refers to playing tennis so is likely have been dropped down the shaft as the shaft head is at the back of a tennis court. Photo Nick Catford

The fixed iron escape ladders in the two ventilation shafts were found to be in good condition and climbable but both shafts were capped at the surface. Large circular holes were noted in the side walls at the base of the two ventilation shafts. These allowed the ventilation ducting to pass from one bay to another while the connecting doors, all now removed, remained closed. The remains of one of the ventilation fans was also seen.

Throughout the shelter, signage remains in good condition. Signs were green with white lettering and apart from bay numbers the following were noted: Exit, Ladies Toilet, Men's Toilet, First Aid Post and Shelter Marshal.

The future

For a number of years during the mid-2000s the Guildford Society ran tours of the tunnels during Heritage Open Days and other occasions. These were stopped in 2009 on health and safety grounds. The electrical wiring was considered to be in a very poor state and Guildford Council required a survey of the tunnels to be conducted to determine the minimum of work necessary to enable tours to to be restarted. The Borough Council has so far declined to spend £15,000 to satisfy Health and Safety requirements.

Additional sources:

Subterranea Britannica website: www.subbrit.org.uk/db/1448649573.html

Time Chamber website: www.thetimechamber.co.uk

Chelsea Speleological Society Records, Volume 14

Sub Brit visit report, uk rec subterranea group 11 July 2001

Entrance in York Road car park. Photo Chris Rayner

Bay 6 was entirely brick lined. Photo Chris Rayner

The junction of bay 4 and bay 7. Brick strengthening was always used at unlined junctions. Photo Nick Catford

One of the stairhead buildings in the Allen House Grounds

The junction of bay 11 and bay 8 looking south. Photo Chris Rayner

Interpretation panel on one of the shafthead buildings

Gents toilet – cubicles are seen on the left with a urinal at the end. Photo Chris Rayner

SB Cotswold Weekend

4 – 6 September 2015

Ken Geddes

Tipper Truck from WWII use of Lower Balls Green Quarry as a source of RAF runway construction hardcore

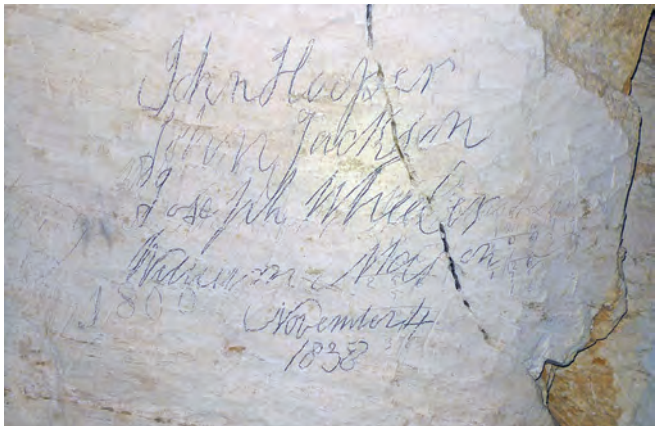
The organisation by Sub Brit member Jon Maisey and his colleagues in the Gloucester Speleological Society (GSS) was comprehensive and highly impressive. Briefings, both on paper and directly on the Friday night and before visits, were informative, interesting and easy to absorb. Detailed documents included maps, a description of the sites, their working and more recent history, together with a Site Risk Assessment – helpful when choosing the right equipment and looking out for things easily damaged such as original graffiti, footprints and easily disturbed bats.

Much information was also provided for those who wanted see more of the area and accommodation was offered for the Sunday night to allow sightseeing on the Monday.

The Royal Agricultural University (RAU)

Our accommodation for the weekend was in the Royal Agricultural University in Cirencester – familiar to some as we used the same venue for the Sub Brit study weekend in 1996. Established in 1845, the RAU was the first agricultural college in the English-speaking world. Much of the support came from the wealthy landowners and farmers of the day; there was no Government support. The first students were admitted in September 1845 when Queen Victoria also granted its Royal Charter.

The college gained full university status in 2013 and now has more than 1,200 students who come from over 45 countries. Rooms at the University were good



Miner's graffiti from 1838 in the Windrush quarry. Photo Jon Maisey

and parking was easy. The quality of the catering was particularly appreciated, both in terms of the food, its presentation and the highly professional and friendly young waiters and waitresses. A well-illustrated talk on recent work in the Windrush Mine was given by organiser Jon Maisey on Friday evening, after the buffet.

The Cotswolds and quarrying

Many people know of the Cotswolds as an area of rolling hills with a mixture of sheep and dairy pasture; arable crops and woodland. The drystone walls are a 'trademark' of the area; the towns are grand with major stone-built buildings – and the villages quaint. The region has justifiably been declared as an Area of Outstanding Natural Beauty. While a few major surface quarries may be seen and traces of 'field quarries' abound, the sheer volume of ashlar and rough-cut stone gives a clue to significant underground quarrying in the past.

Underground extraction was forced on the quarrymen, not by conservationist motives but by the dip of the workable limestone. The quality of the stone won was however exceptional. The limestone was deposited between 100 and 170 million years ago in a shallow sub-tropical sea which covered the area. The limestone strata extracted is Oolite and very thick at Cleeve Hill but thins out towards the northeast and southwest. It rests on another layer of rock called Lias which consists of a mixture of clays, mudstone and limestone, deposited 180 – 205 million years ago. The outcrop of Lias extends from the Dorset coast to Cleveland and can be found in the sea cliffs on the coasts of Dorset, South Wales and Yorkshire.

Main passage in the part of Windrush Quarry accessed via the W1 entrance located at the head of the large cutting in the wood. The photo shows some of the many cart tracks in existence throughout the quarry. Photo Phil Howells

When the limestone was first quarried it was easier to carve into finely detailed decoration due to its water content (known as 'sap'). It dries to give a hard and durable product. Much of the stone was found at surprisingly shallow depths. As a result – and due to the weight and lack of good roads and vehicles – much was quarried locally and it is said that there were originally thousands of small local quarry pits, close to every farmhouse, barn and village. The doorsteps were often literally quarried on the doorstep!

A little history

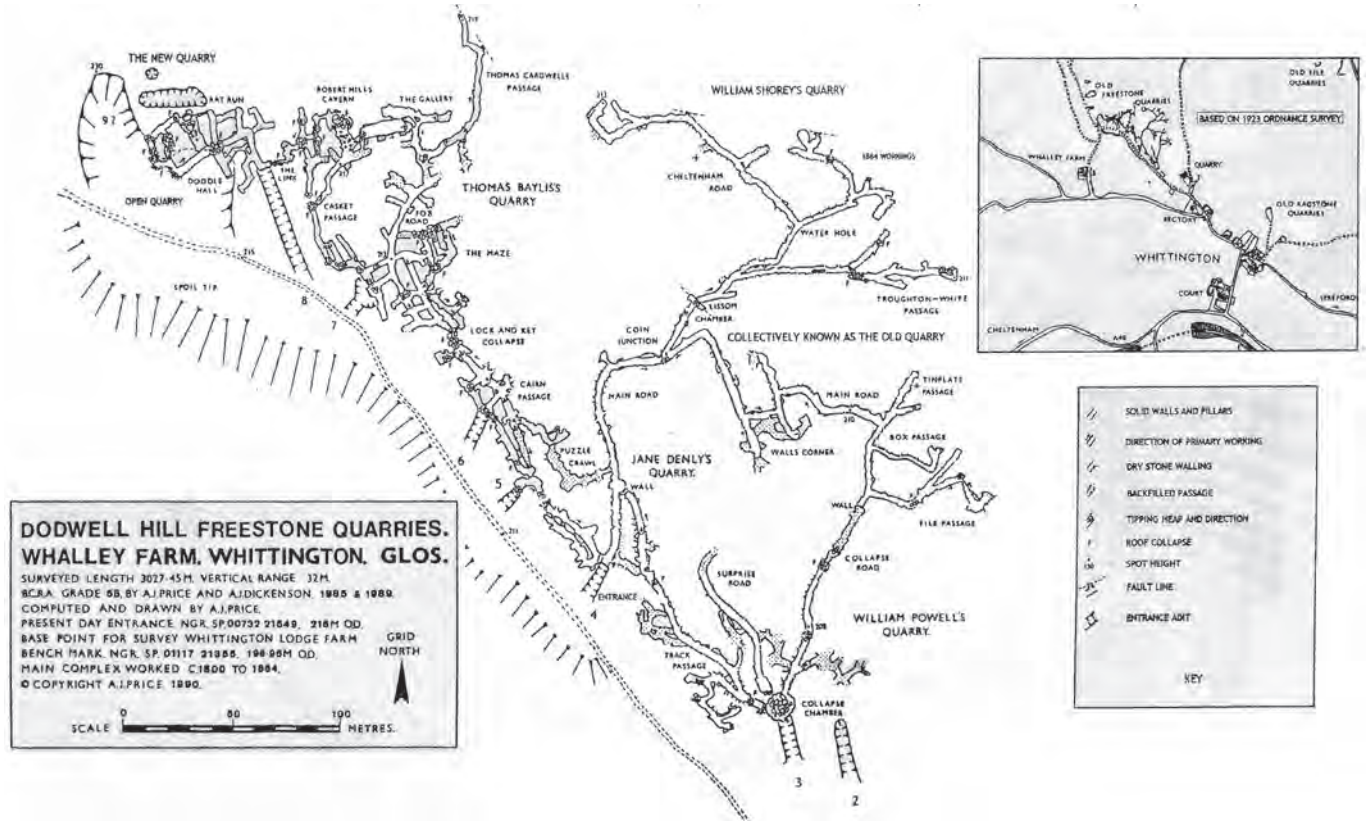
Stone quarrying in the region has a very long history. Iron Age buildings at Crickley Hill were floored with flagstones, but it was the Romans who first used stone for major buildings in places like Bath and Cirencester. The Saxons recycled much of the Roman stone, but also quarried it themselves. Taynton quarry near Burford must have been a major producer as it was listed as an asset in the Domesday Book.

The major churches, cathedrals and castles needed freestone, that is stone which could be worked in any direction. As the cost of transport equalled the cost of the stone at around 12 miles, local quarries thrived. It was convenient to work the Gloucestershire Scarp, where level galleries made extraction easy.

Apart from its uses as building material for houses, floors and walls, stone was also used as roof covering: 'slates'. These were made in two grades. *Presents* were largely as quarried, just a little shaping and a fixing hole drilled. *Pendles* have a grain running through which on exposure to frost splits into thin sheets which can be further prepared for use. These were expensive as the stock had to be kept underground to preserve the moisture content and then spread out in a field when a hard frost was expected. This was highly labour intensive and weather dependant.

Original entrance into the section of Windrush quarry discovered in December 2011. The arch is located very close to the 'stables' where the current second dug entrance is now located. Photo Jon Maisey

The quarrying industry was big in Gloucestershire in the mid-nineteenth century. Hunt's mineral statistics (1860), quoting a survey on England and the Isle of Man compiled two years before, lists Gloucestershire to be equal fifth-largest producer, equal to Somerset with 86 working quarries each. Perhaps predictably, Yorkshire (238 quarries) and Lancashire (122) were first and second. As in other areas, natural stone has now been largely replaced for building in Gloucestershire and the number of working quarries is now very few.



As recently as the 1930s most quarries were worked by hand, but postwar demand for road aggregate, plus a continuing demand for natural stone for building, facing and repairs has enabled the remaining working quarries to mechanise. However, because of the need for higher throughput, underground mining for stone has ceased.

Saturday morning: Whittington Stone Mines

The first visit was to the Dodwell Hill Freestone Quarries at Whalley Farm, Whittington, only four miles from the Regency spa town of Cheltenham. The farmhouse here is a Grade II listed building dating back to about 1680, although there is strong evidence of Roman origins.

The land at Whalley was cleared by the early 11th century while most of rest of the parish of Whittington was still woodland. Whalley Farm was tenanted by the Arkell family in the 1740s – which is of special interest to the author as his mother worked for the Arkells in the mid-1920s. The population of the parish was only eleven in 1086 but peaked at 265 in 1951 (inflated by the presence

Miner's graffiti and a roof fall, Dodwell Hill Quarries

Dodwell Hill Quarries. Jon Maisey, the organiser of the weekend, is on the left

of a military camp), but had dropped back to 126 by 1991. Small enterprises concerned with business training and development and telecommunications were established at Whalley Farm in the 1990s.

Quarrying started early, probably in pre-Roman times. Whittington Church dates from the late 11th or 12th century and would have been built from local stone. In 1625 a field on Dodwell Hill was called Quarry Close and in 1632 stone was supplied for work at Dowdeswell church. A local, John Hill, was listed as a mason in 1608 and his descendants were still following the same trade in the mid-eighteenth century.

These quarries were worked by the Denley family in the early 19th century. They and others provided building stone for Cheltenham's fine houses. Underground quarrying started in earnest around 1800, largely to supply stone for the development of Cheltenham into a

spa town, encouraged by the patronage of King George III. That the quarries were well established by this time is shown by another local man, Robert Newman, being engaged to rebuild the Town Hall at Stratford-on-Avon. Several generations of the Ebsworth family worked as slaters and tilers. A lime kiln operated north of the village in the mid-18th century.

Above the farm in a northerly direction is an open quarry and turning southeast, down a descending track, there is a complex of partially interlinked underground quarries entering into the Gloucestershire Scarp which is around 265m high at this point. These are divided into the Old Quarry and the New Quarry: the whole is collectively is known as Whittington Stone Mines. There were as many as fourteen entrances, starting at the open quarry and running for a distance of over 350 metres on the northwestern side of the track.

This combined underground quarry is one of the largest in the Cotswolds with about three kilometres of passageway. The workings extend in long underground galleries from which the stone was removed using horse-drawn trolleys. Names of quarrymen were marked in places, often using soot from their candles.

Miner's graffiti

Unusually, the coming of the railways had a deleterious effect as they allowed Bath stone to undercut the local product. The local quarries struggled on but were finally closed in 1864, although stone was won for local use up to the 1920s. Spoil from the quarrying formed a long bank which is now covered with trees and thick undergrowth. GSS started digging an entrance to Whittington in the winter of 1972/73 but soon stopped. At the request of the landowner, a different entrance, closer to the village, was examined and the quarry was re-entered in June 1985. Success followed and surveying, photography, further exploration and digging started; a second and more secure entrance was opened later in the year, which was gated.

Saturday afternoon: Windrush

The afternoon was spent at Windrush Stone Quarries. This underground quarry is situated near the village of Windrush just off the A40. Its passageways are said to be usually 2 x 1.5 metres in size, but from observation, frequently larger. The stone was moved by cart as proved

Entry into Windrush 2 Quarry

by the series of obvious ruts along the passageways. Quarrymen's graffiti date from late 18th century or early 19th century, but the majority date from 1860–1909.

Our sandwiches were eaten in the 'Stables' area of Windrush 1, a room-like feature just inside the entrance. The Stables were apparently used by the village band for practice after the mine was closed, this being the last recorded use! The time left allowed a choice of Windrush 1 or Windrush 2, which were not readily accessible from each other, the route being difficult in places and not suitable for large groups. Half of the party opted for Windrush 2, the entrance being only a short walk away.

Windrush is historically the most significant mine in the area, having started in the 15th century when its stone

Underground stone arch

was used in Oxford and for building St George's Chapel, Windsor in 1478–9 and its later rebuilding in 1803–4. It was known to have been worked by the Wright family from before 1840 to its closure (underground in 1900 and totally in 1911). This followed a series of Government Mining and Quarrying Acts dating from 1880 – and especially the new mining safety regulations, which had made it uneconomic.

The main reason to go underground here originally was to avoid the overburden of a creamy-white sticky clay, which eventually burst through the roof. We crossed this clay intrusion before a partially-made horse trough was reached, with the final roof collapse beyond. The trough appears to semi-finished, with the outside walls still rough-cut but marked out, very neatly, for the final shaping. An oddity is that the shape has a cut-off at one corner to fit a specific cavity in a wall, but the intended site is not known. It is also not known if the work stopped when the quarry finished working or whether the clay prevented the horse trough being removed, forcing that part of the quarry to be abandoned.

Partly finished horse trough

Other features are a fine dressed stone arch and a carved face, the latter probably the only one found in Cotswold underground stone quarries. The underground workings closed about 1900, although surface quarrying continued until 1911.

GSS visited the site in 1972 and opened up and explored it in 1981, leaving it gated but accessible with permission. After the initial survey, other local sites took preference until 2010, when a survey of the graffiti was made, followed by digging of interesting leads, identified previously. This led to a large extension in 2011 (Windrush 2), together with another entry. This is approached by a cutting into the hill.

Another big advance was made in 2013, when Windrush 3 was discovered. Amongst other things, a good collection of clay pipes was found in situ. Continuing the surveying and digging led in July 2015 to an arched entrance in the opposite field and away from the A40. Underground, close to all three entrances, evidence of cut and worked stone was found, possibly workshops of a master mason.

Haulage rope or harness marks. Photo Jon Maisey

GSS are currently researching and collating information which will be put together into a book on the history of the mine and the people who worked there. Like many other underground quarries, it was believed that Windrush was mainly worked in the winter when agricultural work was not available. A map of the mine is not available currently as alignment work between the surveys of the various sections is still in progress.

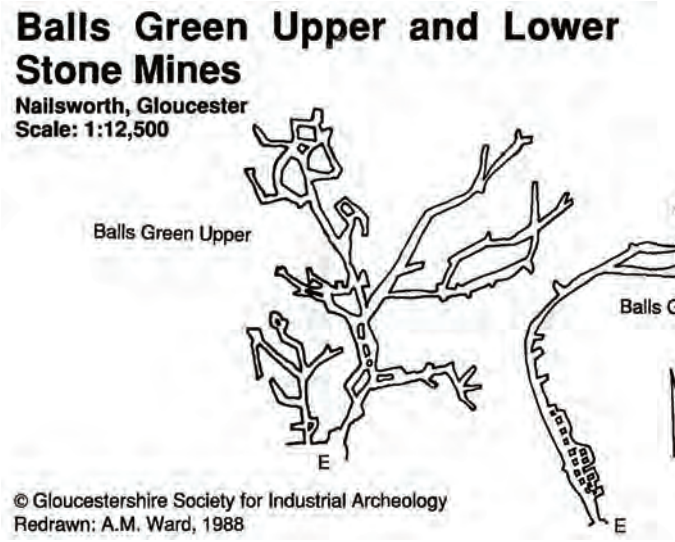
Saturday evening's Conference Dinner was an excellent occasion with an impressively laid table, highly professional young staff and excellent food.

Sub-Brit evening dinner on Saturday night at the Royal Agricultural University

Sunday morning: Lower Balls Green

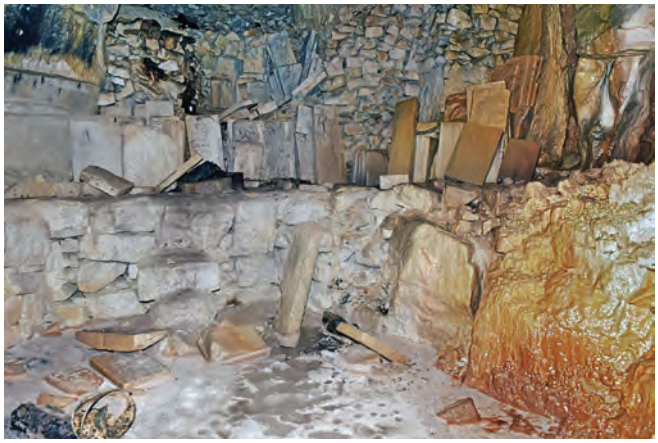
Sunday's first visit was to Lower Balls Green Stone Mine, situated near the hamlet of Balls Green and both Nailsworth and Minchinhampton. The map promised little but the quarry was surprisingly extensive and complex – and leaving the impression that there might be more to discover, if time allowed. Upper Balls Green is certainly bigger and easily accessible, but the Freeholders of the Common, acting as agents for the National Trust, will not grant permission to enter. Both quarries were opened around 1800 and worked finally by the Essex family until 1914.

It is known that stone from Balls Green was used for the King Edward VI Grammar School in Birmingham, the interior of Gloucester Cathedral and the Houses of



Parliament. Local tradition says that these quarries were worked only in the winter, the workforce finding better-paid casual agricultural work at other times of the year.

From 1936 and during World War II the quarry was reopened and the waste rock (deads) was removed for hardcore used in the building of the runways at nearby RAF Kemble and RAF Aston Down. By June 1938, RAF Kemble was ready to receive its first operational unit, and the airfield became one of the main bases for aircraft ferrying in the region. From 1966 to 1983 Kemble was the base for the Red Arrows, after which the US Air Force used it as a maintenance base. All military flights ceased in 1993 and it was renamed "Cotswold Airport" in 2001.



Workshop area, Lower Balls Green quarry.
The last working face is seen beyond

RAF Aston Down started life as RAF Minchinhampton in World War I and was rebuilt, reopened and renamed in 1938 after representations from the locals that their village might be bombed in the event of war! Its main use was for No 20 Maintenance Unit but it was also used extensively for aircrew training. It is now owned by the Cotswold Gliding Club.

Evidence of the WWII use of Lower Balls Green is clear: there is a raised platform on the left after entering. Further in is a wooden sleeper and before, under and after a large roof fall are rails and two side-tipper trucks, one damaged by the fall but the other which was until recently in very good condition. At the far end is an original working area complete with a large face, to the right of which are stacks of finished blocks and to the left, in a side-gallery, a winch. In the 1950s there was an attempt to grow mushrooms in the mine.

Paul Tuffley, the Houses of Parliament and the bee shelter at Hartpury

The stone from Lower Balls Green was widely used locally for construction and walling. However, there is a unique stone 'bee shelter' in the churchyard of Church of St Mary the Virgin Hastings at Hartpury which was made by Paul Tuffley, quarry master and beekeeper, for his ornamental garden in Nailsworth near to the Balls Green quarries. Paul Tuffley was part of a dynasty of Tuffleys, all called Paul.

A winch in the workshop area

The Tuffley family seems to have been comfortably off, as their ashlar stone from several quarries was distributed all over England by the canal system. Stone (with coal) was the classic canal freight as it is heavy and delivery time was not usually critical. When the Houses of Parliament were rebuilt by architect Sir Charles Barry, he appointed Gloucestershire sculptor John Thomas in charge of all stone carving and specified Tuffley's stone for part of the interior work. This combination of Barry, Thomas and stone from Tuffley's Gloucestershire quarries had previously been used for the building of King Edward VI Grammar School in Birmingham.

Bee Shelter at Hartpury Church, originally at Quarrymaster Paul Tuffley's garden, Nailsworth. Made from Lower Balls Green Quarry freestone

Paul Tuffley appears to have been born in 1803, which would make him about 49 at the time of the repossession of his house by his mortgagee, who then sold it on. He also died the same year, but it is not clear if this was before or after the repossession. This must have been an awful double tragedy for Paul Tuffley's wife, losing simultaneously her husband and her home with its beautiful garden. This does not necessarily reflect on the general prosperity of the family as the mortgagee might have thought that it would be more profitable to take the house and sell it. I am advised that for such repossession to take place, a court order must have been made, so this may mean records – and an area for further research.

The bee shelter was made from ashlar limestone, partly freestone and partly weatherstone, with a length of 7.3 m. It stands 2.1 metres high to the top of the ridge tiles. It has three tiers of openings and an elaborately carved ashlar back. The openings have a shelf divided into 28 recesses of an average of 0.45m wide and 0.48m high, plus the five arched recesses at the bottom. It was established that in the construction the ashlar stone had been cut with either a two-man crosscut or a frigbob operated by a single man. A frigbob was a wide saw, operating often by using the weight of the saw itself to do the work.

Axe marks can be seen beneath some of the shelves, showing that they were the first "slice" to be cut from the block. This work would have been done underground as the semi-finished stone parts would have been lighter and easier to transport. The detailed carving marks are all consistent with typically Victorian stone carving methods – a hive of industry!

The bee shelter was rediscovered in 1957 in the garden of the Nailsworth police station and in 1968 was moved to a new site at the Hartpury Agricultural College, 23 miles away, by the Gloucestershire Beekeeping Association. In time, the College needed the area for expansion and the shelter had deteriorated, so the Hartpury Conservation Trust was asked to save it. They received permission from English Heritage to dismantle and re-erect it, with restoration, in the nearby churchyard of the St Mary the Virgin Hastings church, Hartpury.

Matching stone from the extensive Minchinhampton Common weatherstone quarries was found in reclamation yards and freestone directly from the Balls Green Lower quarry. The project cost £180,000 and the bee shelter was 'reopened' in September 2002. It is signposted from the M5 motorway.

Sunday lunchtime: Sapperton

An unscheduled but certainly not unplanned visit to the Sapperton tunnel gave a chance to eat our sandwiches with a pint of local ale at the Tunnel House Inn. This pub and restaurant was associated with the Thames & Severn Canal, whose Act was in 1783 and aimed to provide a broad-gauge link between the two rivers, wide enough to carry Thames barges. The whole canal took five and a half years to complete (see page 46).

Thames and Severn canal, southeastern entrance (Coates Portal) near the Tunnel House Inn

The biggest job was the creation of the tunnel, the longest in Britain at the time at 3.5 km (2.17 miles) long, and it is still the third longest. Its maximum depth below surface is 60 metres (196ft). It was constructed using hand tools and candles or lamps. It has no towpath: barges were legged through the tunnel. It was opened for traffic on 20 April 1789.

The tunnel is nearly straight, and light used to be visible throughout its length. It is nominally 14' 4" wide by 15' 4" high, although because of the amount of rock which fell during blasting in the semi-unlined section through limestone, it is often significantly higher. Much of the rest of the tunnel was driven through fuller's earth and is brick-lined. Unsurprisingly, these are the sections which have suffered from collapses.

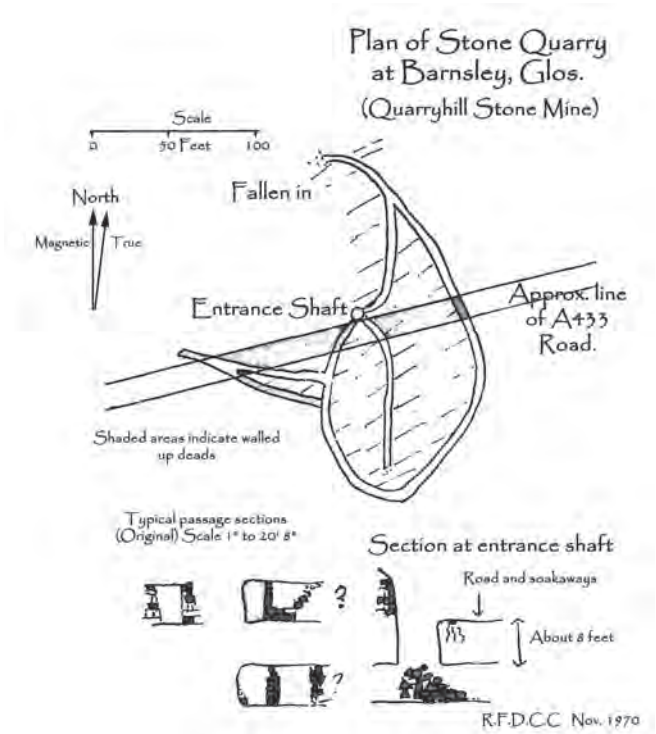
Other problems were springs – welcome when flowing in winter, but water reversed its flow in summer when water sources for the summit level were already sparse. This was addressed as late as 1911 with concrete lining of the sides below water level. Details of the construction and geology can be found on the detailed and well-illustrated account of the tunnel at www.cotswoldcanals.net/sapperton-canal-tunnel.php

Right from the beginning, problems were experienced with leakage of water at many places along the canal and the last boat passed through the tunnel in 1911. As early as 1916, roof falls made it impassable for boats and other falls have occurred since, now blocking it completely. The rest of the canal was abandoned in stages from 1927 to 1933.

Sunday afternoon: Quarryhill stone mine (Barnsley)

The afternoon ended the weekend with a real curiosity at Barnsley (Glos.) alongside the B4425 road, a few miles north of Cirencester. This shaft mine was discovered in December 1969 when the road (then numbered A433) was being improved by making a cutting some 20ft deep through the wooded crest of Quarry Hill. Previously it was believed that there were no shaft-accessed underground stone quarries in Gloucestershire.

The shaft had been capped with a stone dome from the quarry waste after abandonment and then buried in earth



and vegetation. An excavator driver had a very lucky escape when he accidentally dug into this, demolishing it and leaving his digger teetering on the edge of the shaft! There may be other similar mines in the area, two shafts having been discovered close by but not connecting. There is also another small mine in a cutting in the wood.

After entering the securely fenced area, we used a builder's ladder on the far side of the shaft to descend 12ft to the debris cone, with a further 8ft to the passage floor, allowing access. The shaft has obvious grooves from haulage ropes on the road side and at the shaft bottom three galleries radiate. The most westerly is around 500ft in length, eventually circling around and returning to the shaft. This passage starts at about 10ft high. It is roomy but soon deteriorates into a much tighter passage with many waste stone pillars supporting the roof.

Entry into the Quarry Hill Stone mine at Barnsley

Towards the far end of this section, there is a widening to the left which may have been a working area. Eventually a T-junction is reached and the main way on turns right and continues curving right to eventually complete a roughly circular shape, returning to the shaft. Part of the easterly workings is under the road, with 2.4-3.7 metres (8-12ft) of highly jointed rock to support the carriageway over a distance of about 21 metres (70ft). It is difficult to gauge its full extent as the loop-shaped passage is stacked with deads between the passages due to faults in their roofs on their outer sides. The middle passageway enters the area between the semi-circular galleries.

Unlike other Cotswold Stone quarries, there is very little pillar and stall working. At the farthest part from the shaft on the westerly side, a branch passage becomes narrow and irregular, ending in a slope of fines with a flat-out crawl at the top. At least one member tried this, but it seemed without success. As the deads are of far greater volume than the accessible passages, the mine may go further if one or two collapses were dug. There were no signs of rails but some galleries show parallel marks which could have been made by sledges or carts and there is an impression that much of the stone was worked underground, the waste being used for the pillars and the in-filling at the centre.

There are no shot holes and it's reasonable to think that the stone was levered out with wedges and crowbars, making use of natural joints. Lighting seems to have been by candles, and some lumps of clay have been found which resemble the Forest of Dean 'nellies' used in the iron mines. The finished or semi-finished stone was winched out of the shaft leading to the rope marks.

Roof support pillar

Evidence of some of the graffiti in existence throughout the quarry and an example of the stacking of 'deads'. Photo Jon Maisey

The dates of opening, working and closure are unknown but the lack of tramways and use of tallow candles indicate an early mine. Graffiti in the form of names and dates applied by candle smoke have been found on the roof from 1772 and later in 1839. Clay pipe stems were found but had no maker's name, so are not precisely datable. Other quarries in the Nailsworth area were worked intermittently on an as-required basis and then only in the winter. It seems likely that the Barnsley quarry was worked intermittently over the period from 1772 or earlier, until closure. In the winter, the mine is now the home of a colony of Lesser Horseshoe bats.

Thanks are due to Jon Maisey for his organisation of the weekend and the use of his briefing sheets as a basis for this report and for suggested clarifications to the initial draft.

POSTSCRIPT

Submission of this article was delayed by an interesting late development. The Palace of Westminster (Houses of Parliament) was completely rebuilt in 1834 after the 'Great Fire'. The project and design was by Sir Charles Barry and Nicolas Pugin, the two leading Gothic Revival architects. Typically of most governments, Prime Minister Peel wanted a magnificent Victorian Gothic building for the Mother of Parliaments but he also wanted it as cheaply as possible – and built in the shortest possible time. The work started in 1840 with an estimated cost of £724,986 and a projected six years to completion. However, then as now, it took thirty years to complete at a cost of over £2 million!

The key to the project was to find the most cost-effective and plentiful source of building stone which could be delivered economically, and quarries all over the country were investigated and samples of rock obtained. Although Paul Tuffley's Lower Balls Green stone was well known to Barry from the major projects in Gloucester and Birmingham and had the quality of being easily carved into ornate structures with excellent durability, the sheer volume required ruled it out. It was reported that some Lower Balls Green stone was in fact used for internal details and I wanted to investigate the possibility that it was also used for the highly ornate 'pinnacles' on the curtain wall, where its durability would make it highly attractive.

The quarry chosen for the main work for the 1840 building was at North Anston, near Sheffield, an open working quarry supplying magnesian limestone. This was convenient as the stone could be taken by horse-drawn sledges two miles downhill to the Chesterfield Canal and then at the docks onto seagoing vessels which could sail up the Thames and moor right next to the building site. However, magnesian limestone was known to be of poor weathering properties, despite being easily worked. Workmanship on site was allegedly poor and no allowance was made for the 'grain' of the stone.

The stonework of the new House of Commons was deteriorating quickly in the corrosive atmosphere of London and this was obvious as early as 1849, well before completion. By the 1920s extensive remedial work was urgently required as masonry was falling from the building.

By 1928 the original North Anston quarry was closed and Clipsham oolitic stone from Medwells Quarry in Rutland was identified as suitable; repair work started in the 1930s. During this time a number of pinnacles were removed as some had become very damaged. These were put into store and one in fair condition was refurbished and obtained by the then-MP for Clitheroe Sir William Brass in 1937 to be the centrepoint of a rose garden in Clitheroe Castle grounds to commemorate the coronation of King George VI.

Although the air in Clitheroe is less damaging to the stone, the corrosion of the hidden iron clamps used in the 1937 refurbishment was now, seventy-five years on, causing splits in the stone. A project was started by the Clitheroe Civic Society in 2014 to raise money from the Heritage Lottery Fund, with matching public subscription. Many generous individual donors and fundraising events were successful and the restoration was completed on 16 October 2015.

But was the Clitheroe Pinnacle made from magnesian limestone, or was the better weathering Cotswold limestone from Balls Green quarries used for these intricate carved features? Dr Martin Seddon, the restoration team leader, visited the long-disused North Anston Quarry and was lucky to find a householder building a rockery with stone from the quarry. He begged a piece and had it – and a sample from the pinnacle – compared spectroscopically.

Sadly for this account, the two were identical and the pinnacle was made from Yorkshire magnesian limestone and not Paul Tuffley's superior Lower Balls Green Cotswold limestone after all!

All photos by Ken Geddes unless stated

Belfast to Ballymena

Northern Ireland's Cold War Bunkers

Alistair McCann

Ballymena RGHQ seen from an elevated position. The equipment / dirty personnel entrance is on the left with the main entrance in the centre. The air intake and outlets are mounted on the roof above the equipment entrance. Photo from sale brochure – the red line marks the extent of the plot.

Northern Ireland has always been the forgotten part of the UK when it comes to the 'Top 10 List of Secret Bunkers'; up until the early 2000s very few knew the purpose of the windowless buildings dotted around the country. Even now it still surprises people when they find out that the huge grass mound a mile outside Ballymena in County Antrim was the former RGHQ for Northern Ireland.

I became interested in the Cold War during my teens; my grandfather had served with the Royal Observer Corps during World War II and for a brief period in the 1950s. His recollections of his time in the Corps amazed me but surely Northern Ireland was immune from all this; why would anyone want to drop a nuclear bomb on our wee country?

From the end of hostilities in WWII Northern Ireland contained nearly thirty operational airfields. It gave the US Navy a base in Londonderry and allowed the newly formed V-Bomber squadrons a dispersal location at both RAF Aldergrove (now Belfast international Airport) and at RAF Ballykelly on the north coast. It was even discussed in Westminster that nuclear weapons could be stored at the former Royal Navy weapons storage facility at Kilnappy, a few miles from RAF Ballykelly. This made Northern Ireland a target.

Regional War Room and RSG

In his 1984 book *Do you want to die for NATO*, Patrick Comerford surmised that Northern Ireland would also come under attack due the oil and gas storage sites in Belfast and Londonderry and the strategic locations of the province. In later years the *Belfast Telegraph* ran a story that the province would have been attacked by no fewer than nine warheads – a considerable amount considering the size of the country.

The Regional War Room at Mount Eden Park. Photo Alistair McCann

In the mid-1950s Northern Ireland was included in the scope of the Regional War Rooms programme. The site chosen was at Mount Eden Park in Belfast, a quite leafy suburb surrounded by detached houses (now one of the most expensive areas to live in the City). Like the other War Rooms, Mount Eden, which opened in 1954, was a windowless square building sitting one storey above ground and one storey below.

It was 'camouflaged' by trees and bushes and to the casual passer-by it was simply a telephone exchange or pumping station. I imagine that even those who lived beside it knew little of its intended use. At a local government level five 'Grade A' surface controls were built reporting to the main County Borough control in the grounds of Stormont.

The Stormont county borough Control. Photo Alistair McCann

The Mount Eden bunker was in use until 1959 when the War Rooms were replaced by the Regional Seat of Government programme. A site outside Belfast was requested and Gough Barracks in Armagh was eventually chosen. Gough Barracks was WWII Army Headquarters for Northern Ireland which is why it was probably selected for an RSG site. There was a communications complex under the parade ground consisting of buried Nissen huts but this was not used after WWII. Records show the facility was referred to as Regional Seat of Government Northern Ireland.

A file in the Belfast Public Records Office dated 1954 and entitled 'Shadow Control Centre' shows that a number of other locations had been looked at; these included the former Council Offices in Cookstown and Gosford Castle in Markethill. The files even went as far as to allocate the government departments a room in each location to ascertain if there was enough space.

In 1959 Gough Barracks was operated by the Royal Ulster Constabulary. It was never intended that a protected building should be built within the grounds and it was decided that a basement underneath a canteen would have been sandbagged in the weeks leading up to a war footing. Very little exists on site and even less exists in the way of information. There is nothing to suggest the site was ever used in an exercise and during a site visit in 2009, I could see no evidence in the basement to suggest that the site existed any further than simply on paper. Gough Barracks was vacated by the army in the early 1960s and the RSG moved to Castle Dillon, a large country house estate in central Ulster, it was redesignated as Northern Ireland Central Control in 1965. It was a controversial site being owned by the Army and used for interrogation of terrorist activists; it was also Armed Forces Headquarters, Northern Ireland.

Castle Dillon House

With the War Room now empty the building found a new use around 1966 as Belfast County Borough Main Civil Defence Control. Interestingly, a phone line was maintained to the part-built Anti-Aircraft Operations Room (AAOR) at Londonderry (Campsie) even though it was an empty shell but technically on paper it was the North Area Control. As Northern Ireland was part of Great Britain, Civil Defence was stood down in 1968 along with the rest of the UK. The Mount Eden Par war room was mothballed with the County Borough Main Control moving back to Stormont although the bunker was only on care and maintenance.

Incredibly Castle Dillon remained the intended RSG/ Central Control location until the late 1970s when it was decided that Mount Eden Park would be better suited, by then the RSGs having been replaced by the RGHQs. Mount Eden was extensively refurbished, although its 1950s-period filtration system and backup generator remained in use.

An exercise underway at the Belfast County Borough Main Civil Defence Control at Mount Eden Park in the early 1980s

The building saw a number of exercises and was even featured in an edition of the BBC Northern Ireland

programme *Spotlight* in 1982. The footage recently appeared on a special edition of the programme and I was lucky enough to obtain the full original broadcast on DVD. It offers a rare glimpse into an exercise and mainly shows lots of very bored looking Civil Servants crammed into a room with very little to do!

CND Spill the Beans

Mount Eden's peaceful secrecy was smashed only a year later in 1983 when two members of the CND decided to find out what was hiding behind the bushes and trees. I will let them tell their own story….

«In 1983, I remember, we broke in on the Saturday. Paddy and I stayed on site while others took away the films to be developed – an old-fashioned pre-digital word – and then issued a press release; hence the front-page coverage in the Irish News and Irish Times on the Monday morning. The former actually ran a piece on the Tuesday as well.

Meanwhile, yes, we stayed on site. The police were calling by about every 30 minutes or so, and although we had broken the law, we nevertheless wanted to create the impression that we hadn't, at least until the press release went out. But then, on the Monday morning, we reported ourselves to the groundsman... much to his shock horror. A string of officials then came to inspect the scene of the crime, including the police who told us we had committed an offence (trespass, breaking and entry, and disturbing the peace), to which we responded by saying we had known that already, which is why we had reported the fact. Of course, no arrests were ever made.

The NIO (Ed – Northern Ireland Office) then held a press conference in the bunker – so it was a bunker and not just "a store", their earlier story – so to fully vindicate our NI CND position. BBC NI put something onto their news bulletin, and I distinctly remember them saying that we (Paddy and I) "were not available". The phrase has often been a euphemism, of course, and it's probably fair to say that they did not want to interview us. In those days, the Beeb was still very pro-nuke – not showing The War Game, for example ……»

When Civil Defence was revived in the early 1980s, the Northern Ireland troubles put this in a unique perspective to the rest of the UK. Unlike the rest of the country, because of the unique politics of the troubles each County and Borough was not given a designated control centre. Instead there would be a main headquarters and three sub-regional controls staffed by regional government rather than local authority staff.

Regional Controls

In 1982 as an interim arrangement three regional control centres were established with the Main and North-East Controls in the basement of Coleraine County Hall. The West Control was at Omagh County

The teleprinter room in the Belfast County Borough Main Civil Defence Control during the 1983 break-in. Photo from CND

Hall (not in the basement). The South-East Control was located in the former Belfast War Room. The sectors corresponded with the three military sectors that Northern Ireland was divided into. Each of the latter had a military headquarters (North – Derry Barracks, South – Thiepval Barracks, West – Omagh Barracks) and reported to main Armed Forces Headquarters (AFHQ) at Castle Dillon and later to Thiepval Barracks, in unprotected accommodation. This changed in 1991 when the former 31 Group ROC Control on the Lisburn site was taken over as the COMCEN (Communications Centre) following the stand-down of the ROC. Each of these interim regional controls had a six man team to co-ordinate planning made up personnel from the Government, the RUC and the Army.

By the mid-1980s it was becoming apparent that Northern Ireland was way behind the rest of the UK (and even Ireland) in its RGHQ planning. Mount Eden was simply too small and too old to sustain a post-strike government in anything remotely resembling safety. Unlike the rest of the UK whose local councils had access to grants to allow them to build their own protected HQs, Northern Ireland's devolved government was unable to agree to this programme so the local councils did not have this funding extended to them.

In 1985 it was decided that Northern Ireland would have three new purpose-built RGHQs at a projected cost of £350 million. The sites chosen were Craigavon, Omagh and Ballymena; all three were to be built on industrial estates. Work on all three sites was due to commence in 1987 and was scheduled to finish in 1989. Each building would house 235 people consisting of two teams or shifts in each.

Three into One

It got off to a rocky start, as by accident the planning application for the Craigavon site was printed in the local paper and the council – unaware of its impending construction – objected. This debate rumbled on until its

UPPER LEVEL ROOM KEY:

03 - BUILDING SECURITY
04 - GENTS TOILET
05 - MEDICAL EXAMINATION ROOM
06 & 09 - DORMITORIES
07 - FEMALE TOILET
08 - GENERAL DELIVERY STORE
10 - MANPOWER, TRANSPORT, FIRE SERVICE, ENERGY, EMERGENCY WORKS, WATER, HOUSING, PORTS, SHIPPING, ROADS
11 & 36 - POLICE, ARMED SERVICES, COURTS, LEGAL ADVISOR, PRISONS, LAW & ORDER
15 - AGRICULTURE, BANKING, POSTAL, PRINTING
17 & 32 - HEALTH, WELFARE, ENVIRONMENTAL HEALTH
18 > 22 & 24, 26 > 28 - DORMITORIES
33 - EMERGENCY FEEDING, AGRICULTURE
36 - POLICE, ARMED SERVICES, COURT SERVICE, LEGAL ADVISOR
69 - WATER SERVICE, FIRE SERVICE, MANPOWER, RADIO ADVISOR, BRITISH TELECOM, PORTS & SHIPPING
70 - ENERGY, TRANSPORT, ROAD SERVICES
71 - HOUSE MANAGER

BALLYMENA RGHQ - FLOOR PLANS

Drawn by Tim Robinson

LOWER LEVEL ROOM KEY:

73 - STORE
75 - SCIENTIFIC ADVISORS
76 - CONFERENCE ROOM
77 - AREA CONTROLLER, DEPUTY AREA CONTROLLER, ASSISTANT AREA CONTROLLER
78 & 79 - DEPUTY AREA CONTROLLER
90 - TYPING POOL
93 - KITCHEN STORES
96 - REST ROOM
97 - GENTS TOILET
99 - STORE
100 - INFORMATION, CO-ORDINATION, INFORMATION SERVICES, INTELLIGENCE
102 - CONFERENCE
103 - SECRETARIAT
107 - STORE
109 - COMMISSIONER
111 - DEPUTY COMMISSIONER
112 - SECRETARIAT
113 - DEPUTY PRINCIPAL
114 - SCIENTIFIC ADVISORS
115 - BBC OFFICE
116 - BBC STUDIO
117 - COMMUNICATIONS ROOM
119 - PRINTER ROOM
120 - EQUIPMENT ROOM
122 - ELECTRICAL FILTER ROOM

eventual cancellation after the completion of Ballymena. The other site in Omagh was also thought never to have got beyond the planning stage but recent information suggests that the construction did indeed reach a certain point before it was also cancelled after Ballymena opened. As an interim arrangement until official stand-down, Omagh County Hall was designated as West control. A site visit is yet to take place but having spoken to the contractor involved with Omagh; it appears that there is still evidence of the unfinished RGHQ to be seen today.

Cultybraggan RGHQ in Scotland

Ballymena is where we reach our climax. Opened on 22 May 1990 by JK Ledlie, the Deputy Under Secretary for Northern Ireland (I wonder if she cut a ribbon?), it became the last and most technologically advanced RGHQ to be opened in the UK.

Similar to the contemporary bunkers at RAF Chilmark and Cultybraggan, Ballymena is a semi-sunken cut-and-cover with a level above and below ground. Located in a large industrial estate, the site still retained its secrecy reasonably well over the years with very little in the way of photographs either internally or externally mentioning the site by name. Even as late as this year many locals assumed it was a reservoir owned by Northern Ireland Water.

It is surprising also when you consider that during this period while Northern Ireland was still subjected to what we now call 'The Troubles', an industrial estate was not going to afford the same protection as an Army Barracks (it was for this very reason that the 31 Group ROC HQ was located inside Thiepval Barracks in Lisburn). The decision to build in what can only be described as an unprotected location was an interesting one – hidden in plain sight comes to mind.

Earlier I mentioned that Ballymena was one of the most technologically advanced RGHQs in the UK. The reason for this is because unlike other RGHQs Ballymena's communications centre was Radio Frequency (RF) and EMP (ElectroMagnetic Pulse) shielded. In military terms this would be the equivalent of TEMPEST (an interesting 'backronym' of *Telecommunications Electronics Material Protected from Emanating Spurious Transmissions*). All power into these rooms is RF- and EMP-shielded. All doors and cable entry points are shielded. The doors are doubled up so that you operate them like an airlock, only in this case it is RF noise that you aim not to let in. The earthing was taken off to a substantial earthing mat.

What happened at Ballymena after its grand opening in 1990 has proved somewhat harder to determine.

We know at least two exercises took place there as paperwork and maps relating to them are still located inside. Indeed a lot more remains inside not only relating to Civil Defence planning but also to the Royal Observer Corps; it seems a number of items removed from their Thiepval HQ made their way to Ballymena for storage rather than being transported back to the Home Office storage depot at Marchington. The sheer quantity of items remaining shows that Ballymena was simply mothballed and allowed to remain in a state of near perfect readiness for a war that never came.

Some of the rooms in the bunker were open-plan offices. This is room 15 on the upper floor allocated to agriculture, banking, postal and printing

Desks, chairs, bunks with pillows and blankets are stacked ready to go; teleprinters sit in their delivery boxes whilst telephones are lined up in a row on a desk awaiting the civil servant to plug them in. Everything still feels fresh and unused; you almost expect to find a patch of wet paint. This stacking of vital equipment mirrored that at the main UK Government emergency headquarters beneath Corsham. One intent was to help support the story that the bunkers were merely storage locations rather than control centres.

First Visits

My first visit to the site was in 2009; I also managed to get in again in 2010 and in 2011 but then it went dark, my calls and emails went unanswered, and it seemed I had either overstepped a mark or something had changed. Then in late 2012 my mind again returned to the Ballymena RGQH – it was an itch I had to scratch. A flurry of emails and calls put me in contact with the man given the task of looking after the bunker; the words Health and Safety were mentioned a number of times.

I then decided to go to the top and contacted the Office of the First & Deputy First Minister of Northern Ireland (OFMDFM) and asked them to help me; this went well at first but again I was simply ignored for large periods of time. This went on for two years until eventually I had had enough and went to the media.

The BBC ran a piece on the nightly news and it spread to radio and print; it seemed I had got someone's attention as I was contacted the very next day and promised a visit as soon as possible. Brilliant, I can hear you all shout in unison, but sadly no, for when I called to enquire of the date of my visit I was informed that the building was unsafe following a fire in the plant room. The fire lay undiscovered for a period of time and thankfully it put itself out before spreading to other parts of the building.

I made a Freedom of Information Request asking for a damage report; this was their reply to my questions:

1 The fire occurred on 18 June 2014
2 The fire was discovered by the automatic fire detector at approximately 0245
3 The Northern Ireland Fire and Rescue Service was notified
4 Investigations of the damage and its implications are currently ongoing
5 The electrical fire has caused some damage to the main electrical supply and a number of critical systems within the building.
6 It is not known when the building will be safe as investigations of the damage and its implications are currently ongoing
7 The electrical supply to the building has been switched off for health and safety reasons
8 The contents of the building are not documented. The Government carries its own indemnity for buildings and contents.

It wasn't until late January 2016 that I first got word that OFMDFM were considering selling the RGHQ with offers invited in the region of £575,000. A Civil Servant friend tipped me off that it would be announced to the press on 2 February and little did I know how big a story it would become – *Sky News* even mentioned it live. The once-secret RGHQ was now known by everyone, not just in Northern Ireland but around the world.

As per the Ballymena Area Plan 2001, the property lies within the development limit and is zoned as 'white land'. As such, the property could lend itself to a wide variety of uses such as, for example, a secure data or document storage facility. Alternatively, given the original conditions and retained specification, the property may present a superb opportunity for a themed historic/educational tourist attraction, all subject to planning.

Since the announcement I have been working with Ballymena Council to look at the site's potential as a museum and conference facility. It is in the early stages but I personally feel that as it is the best original example of a Cold War RGHQ in the UK, a museum like this in Northern Ireland would work (this is coming from someone who owns an ROC post). Local people will be amazed by what is on their doorstep.

The bunker is being marketed by Lambert, Smith & Hampton, Clarence House, 4/10 May Street, Belfast BT1 4NJ. I will end with some good news – my next visit is now scheduled for 12 April at 1100hrs.

The main entrance or reception

The equipment and dirty personnel entrance with the air intake and outlets above

Description of Ballymena RGHQ

The Ballymena RGHQ was visited by Nick Catford and other members of Subterranea Britannica in June 2002. On this occasion no internal photography was allowed; the reason given was that the bunker was still fully functioning and it may be brought back into use at some time in the future or it may be sold as a 'going concern'.

A second visit took place in August 2007 arranged with the Civil Contingencies Policy Branch at the Office of the First Minister and Deputy First Minister at Stormont. On this occasion internal photography was allowed throughout the bunker and the following description of the bunker is based on that visit. It has been written by Nick Catford and is compiled from information and text from Steve Fox, Robin Cherry, Mark Bennett and Keith Ward. The visit of course took place prior to the fire referred to above.

The bunker is located in a large secure 3.74-acre compound at the end of the Woodside Road Industrial Estate. It is surrounded on two sides by industrial units with a small new residential estate (built since the visit) and open fields to the rear. The RGHQ was built on the surface, and then covered by earth and grassed over. The concrete roof is 0.5 metres thick and the walls 0.3 metres thick. The air intakes and outlets are mounted on the roof at the northeast end of the bunker and not only were they a vulnerable point for blast damage but the intakes would also draw in and concentrate fall-out. It was never intended that the RGHQ should be fully blast-proof but the building was however designed to give a good level of protection against fall-out.

All RGHQs had a main and an emergency entrance. At Ballymena, the main entrance is in the centre of the northwest side with the emergency entrance on the narrow southwest side. There is also an equipment entrance to the upper plant room which doubles as a 'dirty' personnel entrance at the east end of the northwest side. All three entrances give access to the upper level of the bunker and are protected by a double set of blast doors and an outer wire gate. The internal walls are mostly of simple white-painted breezeblocks although the corridor leading to the emergency exit is painted red. All the operational rooms have large pinboards on the walls and most rooms have ducting for the air circulation system hanging from the ceiling. There are numerous telephone extension points, particularly in the large open-plan office areas allocated to 'government departments' or 'uniformed services' ie police, fire service and the military.

The security check point just inside the main entrance was known as 'reception' and compared to WWII and early Cold War bunkers with two-level operations rooms; the later RGHQs were more like an underground office block.

The security office was still fully functioning in 2007

Once inside the main entrance or reception there is a security checkpoint with an opening window into the building security office which is still fully equipped with furniture, phones and a working surveillance system. Most rooms have numbers and names on the doors; the

numbers correspond to the numbers shown on the plan reproduced here. The decontamination unit is combined with the upper plant room. This consists of a suite of small rooms with a basic shower and a bin to hold contaminated clothes. Anyone who had been outside and exposed to fall-out would shower off the contaminated dust and then remove their clothing to be stored in the bin, although no stocks of spare clothing were held.

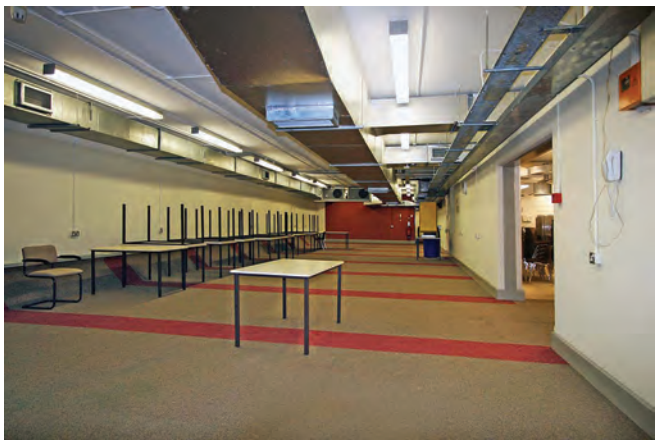
Domestic accommodation is split over the two floors with ten dormitories in the central section of the upper floor. Dormitories are equipped with three-tier metal bunks each of which was provided with a blanket and a small personal locker. Many of the bunks are still in place complete with mattresses and piles of blankets on the floor. Only the Regional Commissioner and Principal Officer had the privacy of beds in their own offices.

The three-tier bunkers in one of the dormitories complete with bedding and ready for sleeping

A small sick bay is located close to the dormitories and alongside the security office; it was provided with a large first-aid kit, an examination couch and a sink. The Community Physician from the DHSS would have provided medical assistance. Male and female toilets were provided together with basins and showers for washing; instantaneous electric water heaters were fitted. Staff would be expected to bring clothing and personal kit for 30 days.

Food for Thought

The canteen and kitchen area occupied a large part of the central section of the lower floor. Crockery and cutlery were kept on site. The kitchen was well equipped with stainless steel ovens, sinks, large fridge-freezers, a meat slicing machine and a bain marie servery. The RGHQ was nominally provisioned for 30 days. It was not expected that the staff would stay inside for all this time, only when fall-out levels made it unsafe to go outside. Food stocks were not permanently kept at the RGHQ but would be built up during the manning stage. Some fresh food might be sought locally possibly under the direction of the Civil Service Catering Organisation but the main food source would be 'compo' rations supplied by the army so the extensive cooking facilities would most likely have been little-used.



One of the largest rooms in the bunker is the canteen with many of the tables still in place. The kitchen is through the opening on the right

The kitchen. The stainless steel servery is still gleaming and has had very little use

A basic 30-day food supply would be held together with a 15-day reserve. Once the basic 30-day supply had been used, further supplies would have been sought via MAFF or the local authorities. The draft Standard Operating Procedures copied sections from RSG instructions which suggested that toilet requisites, sweets, cigarettes and possibly even canned beer might be available but given the reality of the times, it seems unlikely that such items would have been available. There would be a restricted amount of cleaning materials available, but probably only what the peacetime Custodian kept.

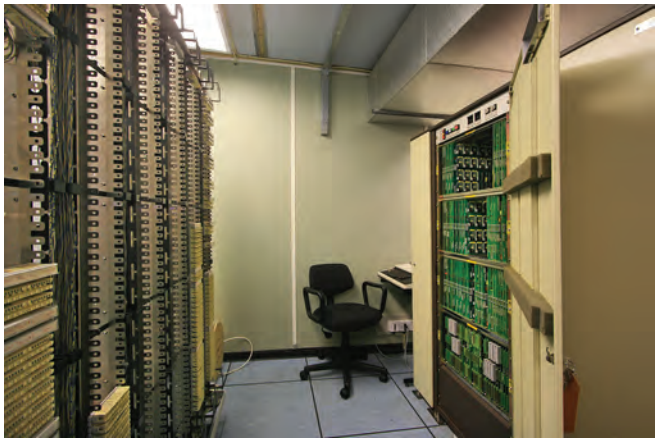
The Regional Commissioner and Principal Officer and their deputies had their own offices at the west end of the lower level. Nearby were offices for the Secretariat, which would be the administrative hub of the RGHQ and the focal centre for handling all the major problems confronting the Regional Commissioner. Its basic function was to co-ordinate the assessment and consideration of problems with a view to ensuring that all the major decisions emanating from the RGHQ had been considered by all those concerned. This would involve, amongst other things, co-ordinating all activities within the RGHQ, issuing instructions on behalf of the Regional Commissioner either within the RGHQ or to the local authority Controllers and other outside bodies, drafting scripts for regional broadcasts and preparing situation

reports for mainland RGHQs and central government.

The Secretariat would also maintain the Information Room that would plot the strategic position of Northern Ireland mainly on maps. As most problems facing the RGHQ would involve more than one department or service the usual method of operation would be by committee. These would either be standing committees meeting twice a day or ad hoc committees established for specific purposes. A Conference room (102 on the lower floor) was available for meetings. Mainland RGHQs had a strong room which was a relatively small room with a security door. No such room was noted at Ballymena although one room did have a medium-sized safe.

Communications Suite

The Communications Centre on 'ComCen' was located in the centre of the lower level. This comprised a suite of three interconnecting rooms with a double wall to provide RF and EMP shielding. Room 122, which is outside the shielded area, is the power supply and RF filter earthing room for this whole suite of rooms. Room 120 is the Equipment Room and housed the local power switching, main distribution frame (MDF), Radio (PYE L700) kit in



The Siemens ISDX3000 ECN is seen on the right with the main distribution frame on the left. An operator's position is seen in the corner

The UPS was also manufactured by Siemens

racks, the telephone exchange (Siemens ISDX3000), the CASE message switch or MSX (two 19" rack cabinets) and the uninterruptible power supply (UPS) to run all of this kit in an emergency where the power fails.

The UPS also supplied smoothing to allow the kit to run during changeover to off-grid local generator supply. There was also an admin position in the room where a technician could administer the MSX. The MSX was a node in the UKs RGHQ Teleprinter ECN network.

The Telephone Exchange (ECN) at Ballymena was the Siemens ISDX3000; the Teleprinter Message Store and Forward System was a CASE SYSTEM MSX. The SX-2000**S** seen in many bunkers throughout the UK is the mainland equivalent of the Siemens ISDX3000 seen in Ballymena. The MSX at Ballymena was the latest model and more up to date than the MSXs systems as used by the Scottish Office and much more modern than the MSX installed and used in the MSX nodes at UK mainland RGHQs. The ECN provided the main dedicated links to mainland RGHQs, the County Council main and standby emergency centres and the County Police Headquarters within the sub-region and the Royal Observer Corps Group 31 Group Control at Thiepval Barracks in Lisburn. These line systems were backed up by radio and there was both a Home Office Radio Room and a Military Radio Room.

The central room in the Comcen (118) has rows of operator positions, with at least two consoles still in place. There are operator's positions for the telephone exchange. The whole suite was still live in 2006, allowing calls to be made into the site during exercise. Other operator oppositions in this room are for the terminal and control positions for the equipment in the Equipment Room (120). Radio positions and other teleprinter positions such as CONRAD and TASS were probably also located in this room.

Operator positions in the comcen. Most of the consoles were never installed but one is seen here.

CONRAD would have been carried in on the day and TASS would have been permanently installed and removed by the Army at closure. The MSX Controller would also have a position in this room – to administer the MSX Switch (a very complex unit based on a CASE time-division multiplexer and Message Store and Forward CPU unit with 30mb Winchester Drive). Some of the kit for this room was in storage in the bunker and had never been installed.

The final room in the suite is the printer room for the kit and operators in the COMCEN. Here all the various teleprinters for the MSX, TASS and presumably CONRAD would have been. The MSX has a whole suite of terminals associated with it. All of the MSX terminal printers are still there. The Printer Room would have to be in the RF / EMP protected area as the Teleprinters (mostly dot matrix types) are all highly susceptible to electromagnetic radiation.

The comcen printer room

A Paper Link terminal

The ComCen was connected to a pneumatic message system called Paper Link. This was an updated version of the Lamson Tube system that propels cylindrical containers through networks of tubes by compressed air or by partial vacuum. Paper Link was designed and manufactured by DD Lamson. Paper Link terminals were noted in a number of rooms on the lower floor, including the large Information Services (100) room.

Broadcast Capability

Just outside the ComCen was a BBC office together with a complete sound studio from which the Regional Commissioner could broadcast via local radio transmitter sites. When reading the following description of the equipment please refer to the pictures of the studio (right) and the office (top right).

The BBC studios installed in all protected accommodation in various parts of the country were to allow local news reports and also a more sustaining service should that be required depending on the scale of the destruction following a nuclear attack. However severe the attack, some people would still be alive and desperate for news.

The Government and BBC policy was to supply that need to the best of the BBC's ability. The equipment was kept simple in concept since it might well be operated by non-technical people. These people would most likely be from the nearest local radio station and therefore have command of the basics. The complement of microphones would be two AKG type D202; one for use over the Audix mixing desk and the other roaming either to a table within the studio or in the office at the table there. This would allow the Regional Commissioner or a VIP to speak over the air whilst the control of the microphone would be in the hands of the person at the mixer.

AKG D202s were chosen as they were reasonably priced, in common use at that time and also had some resistance to EMP. Also connected to the mixing desk was a Uher reel-to-reel tape recorder/player and a double cassette recorder/player. The mixer had two outputs and channels could be switched to either output or both. This facility could be used to feed the loudspeakers with incoming or pre-recorded material but without the microphone signals. The removable cover over part of the mixer was to limit the possibility of inadvertent tweaking of the tone controls.

The small white box in the corner is an interface box where the cassette outputs are paralleled for mono working and audio balancing transformers provided for interconnecting with the desk. To the right are a listening loudspeaker and a small receiver for internal BBC messages. Lower down on the wall is a plug panel

BBC Studio

BBC Office

for cable interconnection with the office. On the left in the office are line interface boxes to BT and to the BBC equipment rack. The office table has the normal telephone and listening loudspeaker. In the corner is where the aerial cables from the roof arrive and are for reception only for Long Wave, VHF and Medium Wave pickup. These would be connected to the monitoring, domestic type receivers in the wooden chassis on the right with their own small loudspeaker.

There are cables around for use in cross plugging on the equipment bay or rack. Lines to and from the Northern Ireland area studio centre and transmitting stations would have arrived at the rack and needed level and frequency adjustments because of the various losses on the BT lines. This was achieved with equalisers and small amplifiers. The line sending amplifiers are next followed by the line receive amplifiers. This is followed by a small jackfield and the power suppliers further down.

The plugging allowed total flexibility so that it was possible to receive an incoming programme and send it on to the local transmitter(s) with or without interruption from the studio. EMP mains filtering was also provided in the rack but audio line filtering was provided by BT elsewhere. The receivers would be for hearing what was going on in the outside world and for checking that one's own contribution was actually being broadcast. There is some acoustic treatment in the studio and office to cut down on the reflections occurring with bare walls.

Power and Ventilation

All the RGHQs were connected to the normal electricity supply but this was expected to be lost in war and they were provided with two FG Wilson diesel generators in a sound-proofed area in the lower plant room. These would supply electrical power once the mains supply had failed. The generators were supplied with diesel via a small daily service tank by the main tank buried in the compound above.

One of the FG Wilson diesel generators in the lower plant room

The main electrical switchboard and generator controls

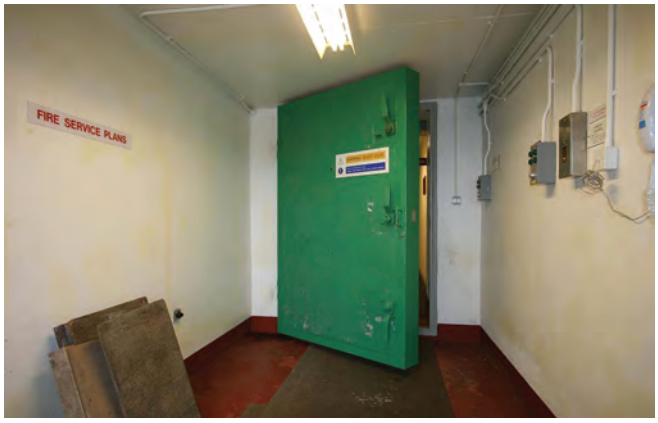
The lower plant room also contained the generator control panels, the main electrical switchboard and the heating and ventilation system control panel. One generator would automatically start 30 seconds after the external power supply failed. The bunker's power needs were divided between essential and non-essential loads. Normally one generator would supply each, but if one generator failed the other could supply the essential load to provide basic communications, lighting and a minimum of air conditioning and cooking.

The generators were sited away from the main part of the building probably because of the noise they produced and their need for an air supply. If the air did not first go through the filters, it would result in the generators building up potentially high levels of radiation.

As well as the decontamination suite the upper plant room contained the complex air supply system. Under fall-out conditions, air would be drawn into the bunker through large vents in the air intake gallery on the bunker roof. This would then be passed through a series of filters, including High Efficiency Particulate (HEP) air filters to remove the contaminated dust. It would then be heated or cooled to maintain a working temperature of 20 degrees centigrade. During peacetime operations, the filters could and would be by-passed.

Filters in the upper plant room

The system could also operate in a completely shutdown mode recirculating the internal air. Air circulated around the bunker in metal ductwork at ceiling height. When unoccupied, the ventilation system maintained the internal temperature at 14 degrees. It was important to keep the air conditioning running even when the bunker was unoccupied to stop the humidity rising which would damage the electrical and communications equipment and lead to the growth of mould. The air would also have to be chilled and dried because when fully manned the staff would give off a lot of heat and moisture. The two plant rooms were joined by an internal ladder.



The main entrance blast door

The Ballymena bunker shows that an RGHQ could provide essential office accommodation for the Regional Commissioner and his staff together with the necessary communications systems. But it also shows that the bunker, assuming it was properly provisioned, could be self-sufficient providing not only reasonably good working conditions but also all the necessary domestic facilities for the staff for around 30 days.

What the future holds for Ballymena should become clear over the coming months. Many of us hope that its unique design as the final phase of the UK's response to nuclear conflict will survive for future generations to explore and study.

All photos Nick Catford unless stated.

Margate Shell Grotto: the Sub Brit Roundel

Martin Dixon

Margate Shell Grotto, on the Kent coast, is an amazing Grade 1 listed subterranean set of winding passages covered by an estimated 4.6 million seashells. Discovered by accident in 1835, the grotto's origins remain obscure. Are its features purely decorative or is there some deep symbolism? Was it built as a temple or for a secret cult or just as a decorative retreat? There is no record of its construction so the answers will probably never be known.

What is known is that the grotto has been open to the public since 1838 and that over the years the delicate mosaics have in places become detached and slightly damaged. A few years ago the grotto started an appeal to help fund the restoration of some of the damaged 'roundels' which form the focus of many of the underground panels and which had suffered particularly badly.

Subterranea Britannica sponsored the restoration of one of the roundels – a painstaking operation and one that needed full listed-building approval before commencement. Conservator Robert Smith, who has also worked on the grotto at Painshill Park, undertook the delicate task and, now the work is complete, members can see what a fine job he's made of it.

To recognise the contribution made by Sub Brit, members can benefit from a one pound reduction from the normal admission charges on production of a copy of *Subterranea*. The grotto is an ideal site to complement the nearby and recently reopened tunnels at Ramsgate described fully in *Subterranea* issue 38.

Roundel partially made

Sub Brit Takes to the Air

Chris Rayner

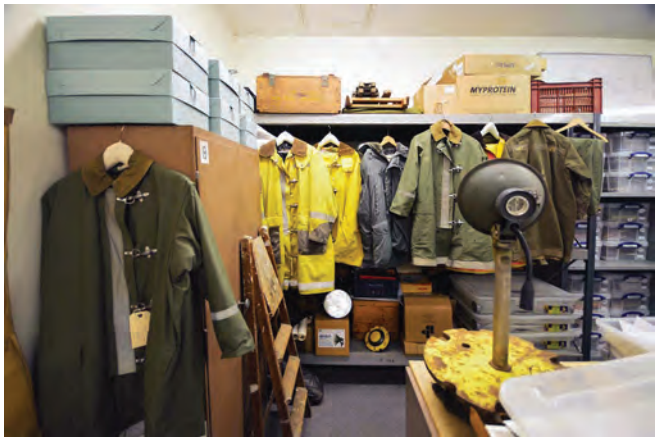
Military structures have always been an important part of Sub Brit's interest, whether for attack, defence, control, storage or shelter. Indeed, a database of several hundred airfield World War II Battle Headquarters has recently been added to the SubBrit website, thanks to the research of Sub Brit members Mike Tucknott and Iain Taylor and with the assistance of our webmaster Richard Seabrook. These serve as a reminder of the many types of underground shelters and bunkers that can be found on airfields, ranging in size from smaller structures, such as Stanton shelters and dispersal pen shelters, up to the much larger ones, such as Hardened Aircraft Shelters (HAS) and control bunkers.

Airfield Research Group

Thus, the Committee was interested to take up an invitation from the Airfield Research Group (ARG) to discuss opportunities to develop the relationship between our two societies. So what exactly is the Airfield Research Group? Many of us will be familiar with their excellent website and their forum, the Airfield Information Exchange, and may have noticed its rebranding over the Christmas break. You may also have come across some English Heritage research papers on airfields online written by some of their members, or seen their excellent members' magazine *Airfield Review*. Well, in many ways they are an organisation very much like our own.

Sub Brit and ARG members in building 76 at Alconbury. (Left to right) Paul Bellamy (ARG), Tony Radstone, Martin Dixon & Paul Francis (ARG). Photo Chris Rayner

Their origins are similar, back in the pre-internet dark ages when information was shared mostly by word of mouth. Their own genesis came about following an article titled "Too Many Airfields" in the September 1973 issue of *Aviation News*, which reported on a government committee's conclusions on airfield sites. A concerned reader wrote to the magazine and suggested the formation of an airfield interest group. However, getting together in those days was complicated by fuel shortages and the consequent high pump prices following the Yom Kippur war, and a hiatus of several years followed in which the chosen few swapped information and photographs by post about site locations and access. They got to meet for the first time in 1977, appropriately enough, at the RAF Museum in Hendon, and thus the Airfield Research Group was born.



Part of the ARG collection. Fire service bunker coats 1970s/80s from Chicksands and Alconbury and a runway threshold light from Alconbury. Photo Chris Rayner

Airfield enthusiasts, like the early members of SubBrit, were faced with a lack of written information. In the case of the ARG, this was about the history of airfields and their component buildings and structures, and so members set out to find out and share whatever they could learn. Books were few and Ordnance Survey plans at the time typically did not show airfields, usually leaving sites blank or in a pre-airfield idealised state. Military airfield plans only began to become available from 1976 on, and even then only those of disused airfields. Still there were some consolations, which included being able to sit on the grass at the end of the Gatwick runway in the early 1970s watching airliners take off and land. As time went by, more records became available as documents were made available by the RAF's Air Historical Branch and the Public Record Office (later renamed the National Archives). Meanwhile ARG became involved with, firstly, English Heritage in preparing guidelines for listing military and civil airfield buildings in England in 1994, which would result in around 150 listings, and then in the Defence of Britain project, between 1995 and 2001. Getting to grips with the internet led to a new phase in the Group's development, with the launch of the online forum *Airfield Information Exchange* (AiX) in 2008, allowing the participation of non-members in airfield discussion and visits. Most of ARG's activities concern military sites but some members also follow the history of commercial airfields too.

Priceless Archive

Their archive had existed in some form for a couple of decades, stored in members' houses; however there was a concern that these records could be lost or damaged unless brought together into a single collection. Knowing of the existence of a number of interesting unused buildings was a tremendous advantage of being an organisation that studies airfield buildings (air-raid shelters and tunnels don't cut the mustard when it comes to

document storage), and various tempting possibilities, such as the old operations room at former RAF West Raynham and the guardroom at former RAF Upwood were considered, but were found to be unsuitable for one reason or another.

But then, as a result of the Group's building recording work at RAF Alconbury, a room in building 76 became available which seemed to be perfect, and was used for several years until the whole building was required by another tenant. They were then, however, offered their current home in another building on site, which is where we met them on a bleak and wet January day to discuss ways in which SubBrit and ARG might work together and pool information in the future.

Sub Brit agreed to set up ARG as 'exchange members' – a relationship we already have with a number of similar organisations such as the Channel Island Occupation Society, Wealden Cave and Mine Society and Grampian Speleological Society. In this way we can share information and alert members to events and sites of interest.

Collaboration

Organising joint visits is another possibility. ARG's Archive is a fascinating collection, comprising books, maps and other documents housed on airfield-surplus archive storage racking and plan chests (another 'plus' of surveying and recording airfield buildings!). In addition there is a growing collection of artefacts, as shown in the accompanying photographs. The Airfield Research Group have very kindly offered to host a Sub Brit members' visit to their Archives later this year, with the possible addition of a visit to one of the most interesting buildings on the airfield.

RAF Alconbury in Huntingdonshire is one of the last two World War II US Eighth Air Force bases in the UK still under the control of the USAF. It has its origins in 1938 as a bomber scatter field for Battles, later Blenheims, and was then allocated to the USAAF in May 1942.

ARG Archive Office with mannequins wearing post-WWII USAF uniforms. In the foreground is a WWII USAAF HILV landing light, and B-17 pilot and tail gunner's armour plates.

Photo Chris Rayner

During the Cold War it again came under US control and was used as a base for reconnaissance, electronic warfare and "Aggressor" missions by B-45, RB-66, RF-4C, F-5 and TR-1 spy planes. It was during the latter period that the hardened TR-1 Avionics Maintenance Facility was constructed. This was completed in 1989 at a cost of $69 million, just in time for the fall of the Berlin Wall and effective end of the (first) Cold War.

Magic Mountain

Looking from the distance like a small hill, this building is popularly known as "Magic Mountain". The structure was given a well-deserved protected Grade II* listed status because, in the words of English Heritage, it is "unique … because of its size, form and internal survival of the vehicular decontamination unit and compressed air repressurising system …. It is the most sophisticated hardened structure remaining (in Britain)."

Magic Mountain has a number of substantial blast doors. This is the entrance to the personnel decontamination suite, seen from inside the main entry blast airlock. Photo Nick Catford

The two-storey building includes a drive-through access roadway for vehicle decontamination and a massive concrete burster cap over the structure to absorb the impact of a missile before it can penetrate the bunker roof. Inside the portcullis-type blast doors and personnel decontamination suite were workrooms where spy-plane electronics could be serviced and data retrieved. On the lower floor were smaller workshops for the TR-1's general flight systems; radios, radar, controls, instrumentation, etc. Compressed air cylinders, still in situ, were also located here for maintaining air pressure in the event of an attack, and generators along with the telephone frame room.

In addition there are many other fascinating structures at Alconbury, although sadly many have recently gone as much of the airfield is being built on for housing, business parks and associated schools and so on. Luckily a couple of other structures do have listed protection, including the WWII control tower (known as a 'watch office' at the time) and one of the Hardened Aircraft Shelters.

We are very grateful to the Airfield Research Group for offering a visit to their archives and hopefully 'Magic Mountain' later in the year – more details to follow. We also look forward to ongoing close relations with them. Thanks too to Paul Bellamy of the ARG for background details on RAF Alconbury for this article.

For more details on the Airfield Research Group and membership, please refer to www.airfieldresearchgroup.org.uk

Discounted Cotswold Shopping

Cotswold Outdoor have granted Sub Brit members a 15% discount on their products (excluding sales and special offers). The details are included in a letter on the website at www.subbrit.org.uk/docs/discount-cotswold-outdoor.pdf

If you are not able to access the website, then please contact us with an SAE for a copy of the letter.

The discount code can be used in any of their 58 stores (there is a barcode on the letter), and for telephone and online orders.

**** Please do not share or abuse the code as this may lead Cotswold to withdraw it which would be a great shame and spoil things for the rest of our members. ****

Here is an introduction from David Hague of Cotswold:

"Cotswold Outdoor are proud to be a supporter of such a prestigious organisation as Sub Brit. As most of your members are aware, Cotswold Outdoor is a multi-award winning retailer with numerous thriving stores located nationwide. Not only are we proud of our knowledgeable staff, but our stores stock one of the most comprehensive ranges of outdoor clothing and equipment in the UK. With a huge range of footwear, waterproof jackets and fleeces, tents, sleeping bags and outdoor accessories, we offer one of the best selections of clothing and equipment right on your doorstep.

Whoever you are and whatever you need, when you shop with us you can be assured of expert, award-winning service and advice that comes from 40 years of experience in retailing. We're really looking forward to welcoming you to our store, online or over the phone soon. I hope that our discount helps your members purchase the right kit and equipment as they continue with their important and valued pastime. We are passionate about giving the right advice and recommending the right clothing and equipment so you can have peace of mind while out in (or should that be under!) the field."

Minutes of Committee Meeting 16 January 2016 at Elmgrove Hall, Walton

Attendees: Martin Dixon (Chairman), Linda Dixon (Secretary), Nick Catford, Tony Radstone, Bob Templeman, Richard West, Richard Seabrook, Paul Sowan. **Apologies:** Chris Rayner, Chris Wilkins, Tim Wellburn. Jason Hughes and Alistair Graham Kerr attended as co-opted members of the Committee.

Company/Charity Management

Tony has sent the 2015 paperwork to our Accountant to produce the Accounts. Martin has drafted the Trustees report which was approved and will also be sent off.

Nominations for next year's committee were taken.

Channel Management

The Committee discussed a paper produced by Martin reviewing our communication channels e.g. the Forum, SubT, Social Media. All agreed this provided a good template clarifying the aims for each channel.

Sub Brit website content

Tony, Chris and Martin have done a splendid job in adding lots of new pages – approx. 80 so far.

Subterranea

A set of Guidelines to help new authors has been drafted. These will be sent to anyone who would like to write an article for *Subterranea.*

Day Meetings

All is in hand for the Spring Meeting and AGM; Chris Rayner is working on Belfast as a venue for the Autumn Meeting, with a day of visits on the Sunday.

Visits/Trips

The **Rome** weekend (Martin, Linda & Tony) 6–9 May is going well. Bookings start today (post meeting note: all full within 48 hours). Chris Wilkins is setting up a pilot Sub Brit trip to **Gibraltar.** Tim and Tony will attend to ensure all goes well for future visits. Chris Rayner is working to set up a day-trip to **Mimoyecques** in July. There will be no Sub Brit UK weekend this year as we will be doing visits in Belfast. We will look at Isle of Wight and possibly Scandinavia for trips in 2017. Other trips will be in the Diary.

Day Visits/Trips

Martin is working to try and set up a repeat trip to Daws Hill. We're also investigating Clapham South/Common and a repeat trip to Westcott. Several trips were discussed and will be advised to members in due course. Sub Brit has requested a stand at the Fawley Hill Weekend 20–22 May.

Memberships

The renewal process worked well this year, with record numbers of members renewing in the early days of January. We will look to ask our mailing house, Martel, to do the renewal chasers in March. There will be a reminder in December's *Subterranea*.

Shop Sales

This is going very well, helping to shift the spare copies of back issues of *Subterranea*. Our link through to Amazon also generated a modest income for Sub Brit for orders placed by members during Christmas. Linda will Index SubTs 31–40 for inclusion in the next *Subterranea*. It will also be accessible on the Forum.

Sundry items

We agreed to set up the Airfield Research Group as exchange members. We will order a few more SB Bump Caps for sale at the Spring Meeting. The Committee agreed that it would be appropriate to pay a modest amount towards travel costs for attendance at these meetings as we'd like to ensure more distant and less well-off members can participate fully in the running of Sub Brit.